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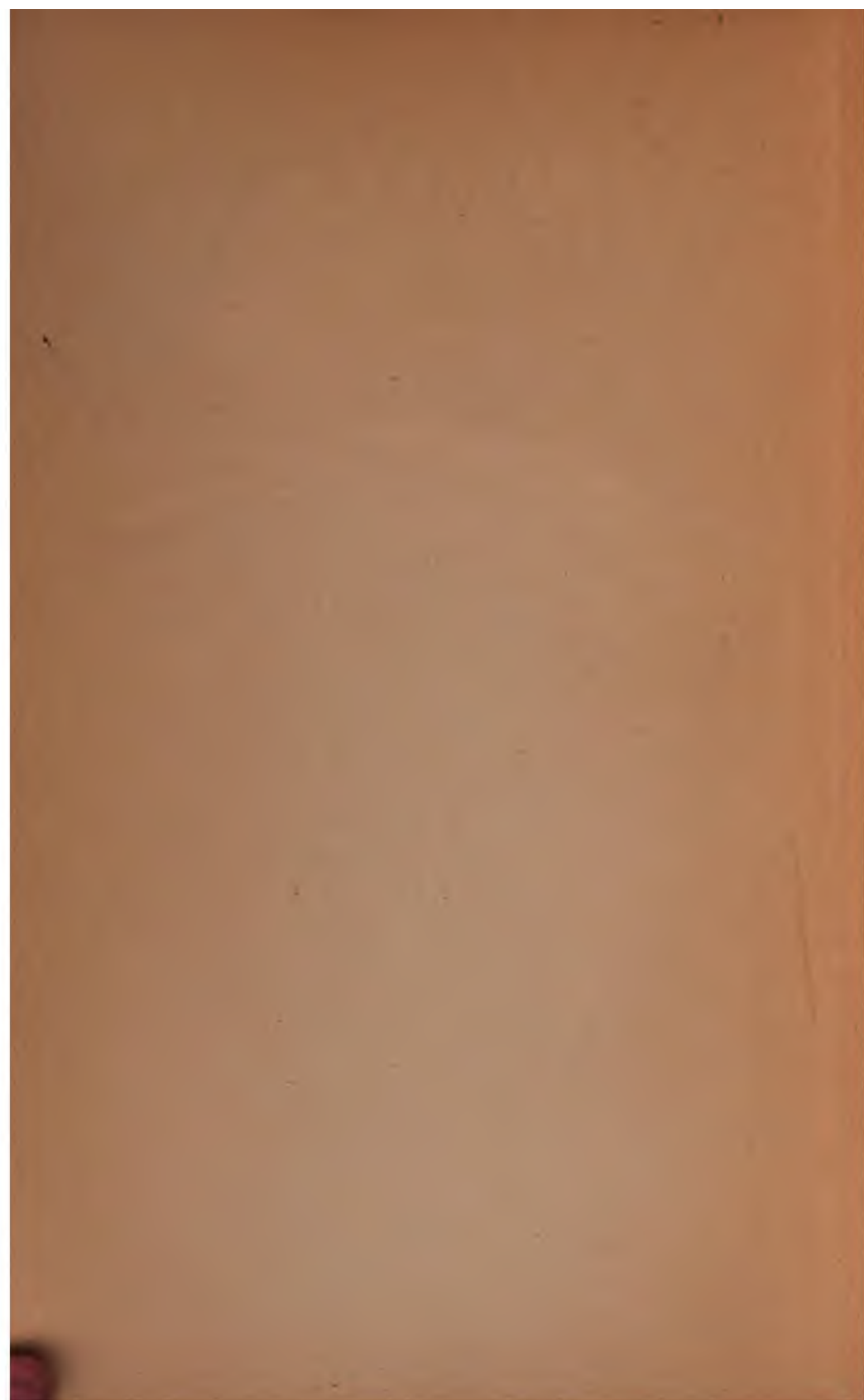
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THE DISEASES OF
THE NOSE AND ITS ACCESSORY SINUSES

THE DISEASES OF
THE NOSE
AND ITS
ACCESSORY SINUSES

BY

H. LAMBERT LACK

M.D. (Lond.), F.R.C.S.

Surgeon to the Throat Department of the London Hospital and Lecturer on Diseases
of the Throat to its Medical College (University of London),
Surgeon to the Throat Hospital, Golden Square, etc.

WITH 124 ILLUSTRATIONS

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To
WILLIAM WATSON CHEYNE, F.R.S.

L14
1906

PREFACE.

IN 1899 I was awarded the Jacksonian Prize for an Essay on "The Pathology, Diagnosis, and Treatment of the Inflammatory Affections of the Nose and its Accessory Sinuses and Air-cells." Some of the investigations for that work have been continued and amplified, the whole Essay has been thoroughly revised, and additional chapters have been added in the endeavour to make the present book a complete treatise on the Diseases of the Nose.

It has been my aim to give a concise yet full account of the Diseases of the Nose and its Accessory Sinuses, more especially with reference to their Pathology and Treatment, and I trust that what I have written may be of service to those Practitioners and Senior Students who intend to devote special study to this subject. The chapters have not all been written upon a uniform plan. A systematic account has been given of subjects upon which there has been no recent controversy, and upon which no great divergence of opinion exists. On the other hand, I have not hesitated to devote considerable space to the consideration of doubtful points, and, whilst indicating my own views, I trust I have stated fairly the opinions of others.

To increase the usefulness of the work, I have added at the end of each chapter a short bibliography, containing references to the more important recent contributions to the subject. Every endeavour has been made to keep this list as short as possible, and to include in it nothing but what the student who seeks fuller knowledge or more details upon any particular point may consult with advantage. Minor references are given as footnotes. To ensure greater accuracy, all the references have been carefully verified by Mr. Archibald Clarke.

I must here acknowledge my great indebtedness to the following works, which have been frequently alluded to in the text:

Morell Mackenzie, *Diseases of the Throat and Nose*. Vol. ii.
London. 1884.

Spencer Watson, *Diseases of the Nose*. 2nd Edit. London. 1890.

- Greville MacDonald, *Diseases of the Nose*. 2nd Edit. London. 1892.
- Bosworth, *Diseases of the Throat and Nose*. 2nd Edit. New York. 1898.
- Heymann's *Handbuch der Rhinologie und Laryngologie*. Bd. iii. Wien. 1899.
- Grünwald, *Die Lehre von den Naseneiterungen*. 2nd Edit. München. 1896.
- Moritz Schmidt, *Die Krankheiten der oberen Luftwege*. 3rd Edit. Berlin. 1903.
- Logan Turner, *The Accessory Sinuses of the Nose*. Edinburgh. 1901.
- Hajek, *Pathologie und Therapie der entzündlichen Erkrankungen der Nebenhöhlen der Nase*. Wien. 1899.

Finally, I have the pleasant task of acknowledging my great indebtedness to numerous friends. To Mr. Watson Cheyne I am especially indebted for generously placing his private laboratory at my service, thus enabling me to carry out much histological research which I should otherwise have been unable to undertake. I am indebted to Mr. C. A. Parker, to Dr. Ernest Playfair, and to Dr. Atkinson for the careful manner in which they have read the proof-sheets and for many valuable suggestions. Dr. Arthur Keith kindly read and revised the chapter on the Anatomy of the Nose, and my friend Mr. Morley Roberts has freely given much of his valuable time to reading the final proof-sheets.

For many of the illustrations I am indebted to Messrs. Longmans, Green & Co., who kindly permitted me to use the illustrations in the section I wrote on Diseases of the Nose for Cheyne and Burghard's *Manual of Surgical Treatment*, Part v. Div. 2. Of the original illustrations the majority have been drawn by Mr. J. E. Adler, and others by Messrs. Collings & Co., to both of whom I am greatly indebted. The illustrations of instruments were kindly lent by Messrs. Mayer & Meltzer.

The Index has been compiled by Mr. Archibald Clarke.

H. LAMBERT LACK.

TABLE OF CONTENTS.

CHAPTER I.—THE ANATOMY OF THE NOSE.

	PAGE
The Septum—The Turbinated Bodies—Development,	1-10
The Accessory Sinuses—The Antrum—The Frontal Sinus and Infundibulum— The Ethmoidal Cells—The Sphenoidal Sinus,	10-24
The Vessels and Nerves,	24-25
Histology—Path of Air Stream—Functions of Nose,	25-32

CHAPTER II.—THE EXAMINATION OF THE NOSE.

Illumination—Nasal Specula—Anterior Rhinoscopy—Median Rhinoscopy—Pos- terior Rhinoscopy—Digital Examination,	34-42
---	-------

CHAPTER III.—GENERAL CONSIDERATIONS ON TREATMENT.

Methods of Cleansing the Nose—Intra-Nasal Operations—Local Anaesthesia— Cocaine—Supra-Renal Gland Extract—Nasal Antisepsis—The Application of Caustics—Arrest of Haemorrhage,	43-54
---	-------

CHAPTER IV.—NASAL OBSTRUCTION, ITS SYMPTOMS AND EFFECTS.

Classification—Effects on Nose and Neighbouring Organs,	55-60
Deformity of the Jaws and Teeth,	60-70
Effect on the General Health—Development of the Chest—Reflex Effects,	70-76

CHAPTER V.—GENERAL CONSIDERATION OF SYMPTOMS OF NASAL DISEASE.

Alterations of the Nasal Secretions—Cerebro-Spinal Rhinorrhoea—Rhinitis Caseosa,	76-81
Collapse of the Alae Nasi and its treatment—Epistaxis, its varieties and treatment,	81-87
Headache and Neuralgia,	87-90
Effect on Neighbouring Organs—Anosmia, Parosmia,	90-96

CHAPTER VI.

Foreign Bodies, Rhinoliths,	97-103
---------------------------------------	--------

CHAPTER VII.—AFFECTIONS OF THE SEPTUM.

	PAGE
Deformities—Thickenings and Deflections—Varieties—Treatment, . . .	104-118
Synechiae—Congenital Atresia,	119-121
Abscess of Septum,	121-124
Perforations of Septum,	124-126

CHAPTER VIII.—ACUTE INFLAMMATION OF NOSE.

Simple Acute Rhinitis—Drug Rhinitis—Traumatic Rhinitis—Purulent Rhinitis— Symptomatic Rhinitis—Fibrinous Rhinitis,	127-138
---	---------

CHAPTER IX.—CHRONIC INFLAMMATION OF NOSE.

Chronic Rhinitis Simplex,	139-142
Hypertrophy of Inferior Turbinate,	142-149
Rhinitis Sicca,	149-152

CHAPTER X.—ATROPHIC RHINITIS OR OZAENA.

Etiology—Pathology—Clinical Features—Treatment,	153-172
---	---------

CHAPTER XI.—NASAL POLYPUS.

Clinical and Pathological Features—Changes in the Bone—Clinical Evidence of Bone Disease—Etiology—Symptoms—Diagnosis—Treatment of Various Stages,	173-199
---	---------

CHAPTER XII.—CHRONIC INFECTIVE DISEASES OF THE NOSE.

Syphilis—Tertiary Syphilis—Inherited Syphilis—Tuberculosis and Lupus—Leprosy —Rhino-Scleroma—Glanders,	200-218
---	---------

CHAPTER XIII.—TUMOURS OF THE NOSE AND ACCESSORY SINUSES.

Benign Growths—Papilloma—Fibroma—Chondroma—Osteoma—Fibro-Angioma, . . .	219-226
Malignant Tumours—Sarcoma—Carcinoma—Symptoms—Diagnosis—Treatment, . .	226-239
Fibroma of Post-Nasal Space,	239-242

CHAPTER XIV.—THE NASAL NEUROSES.

Introduction—Etiology—Classification—Evidences of a Nasal Reflex, . . .	243-249
Hay Fever—Rose Fever—Paroxysmal Rhinorrhoea—Causes—Symptoms—Treat- ment,	250-256
Asthma—Evidence of its association with the Nose—Nasal Treatment, . . .	256-265

CONTENTS.

xi

CHAPTER XV.—SUPPURATION IN THE ACCESSORY CAVITIES OF THE NOSE.

	PAGE
Etiology,	268-277
Pathology,	278-283

CHAPTER XVI.—ACUTE SUPPURATION IN THE ACCESSORY SINUSES.

Symptoms and Treatment,	284-288
-----------------------------------	---------

CHAPTER XVII.—THE SYMPTOMS OF CHRONIC SUPPURATION IN THE ACCESSORY SINUSES.

Latent Empyema—Manifest Empyema,	289-297
--	---------

CHAPTER XVIII.—THE DIAGNOSIS OF CHRONIC SUPPURATION IN THE ACCESSORY SINUSES.

Latent Empyema,	298-308
Manifest Empyema,	308-310

CHAPTER XIX.—THE TREATMENT OF CHRONIC SUPPURATION IN THE ACCESSORY SINUSES.

Introduction,	311-313
Antrum Suppuration—Alveolar Puncture—Puncture of Inferior Meatus,	313-322
Radical Methods of Treatment,	322-327

CHAPTER XX.—THE TREATMENT OF CHRONIC SUPPURATION IN THE ETHMOIDAL CELLS.

Intra-Nasal Operation—Curettement—External Operation,	328-334
---	---------

CHAPTER XXI.—THE TREATMENT OF CHRONIC SUPPURATION IN THE FRONTAL SINUS.

Intra-Nasal Methods,	335-339
External Operation—Obliteration—Killian's Method—Ogston-Luc Operation—	
Results,	339-351

CHAPTER XXII.

The Treatment of Suppuration in the Sphenoidal Sinuses,	352-356
---	---------

CHAPTER XXIII.—MUCOCELES OF THE ACCESSORY SINUSES.

	PAGE
The Ethmoid—The Frontal Sinus—The Antrum,	357-366

CHAPTER XXIV.—AFFECTIONS OF THE POST-NASAL SPACE.

Post-Nasal Catarrh,	367-368
Post-Nasal Adenoid Growths—Etiology—Pathology—Symptoms—Diagnosis—	
Expectant Treatment—Operation—Prognosis,	368-383

APPENDIX.

Some useful Formulæ for Local Application,	384-387
--	---------

LIST OF ILLUSTRATIONS.

FIG.	PAGE
1. The Nasal Septum, - - - - -	2
2. Vertical Antero-Posterior Section through Right Nasal Fossa, - - -	3
3. Vertical Antero-Posterior Section through Left Ethmoidal Region, - -	4
4. Vertical Transverse Section of Nose, - - - - -	5
5. Vertical Transverse Section of Nose, - - - - -	6
6. Vertical Oblique Section of Nose, Antrum, and Orbit, - - - -	7
7. Horizontal Section of Nose, close to Floor, - - - - -	8
8. Vertical Transverse Section through Nose of Infant, - - - -	9
9. Vertical Transverse Section through Nose of Child, - - - -	9
10. Skull, showing Relation of Nasal Accessory Sinuses to Surface, - -	10
11. Asymmetry of the Antral Cavities, - - - - -	12
12. Asymmetry of the Frontal Sinuses, - - - - -	15
13. Dissection of the Frontal Sinuses, - - - - -	17
14. Vertical Antero-Posterior Section through Nose, showing Infundibulum, -	19
15. Section of Frontal Bone showing Ethmoidal Cell and Frontal Sinus, -	20
16. Section through Posterior Part of Nose showing Relation of Optic Nerves to Accessory Sinuses, - - - - -	21
17. Horizontal Section through Ethmoidal Region of Nose, - - - -	22
18. Horizontal Section through Ethmoidal Region of Nose, - - - -	23
19. Microscopical Section of Mucous Membrane of Inferior Turbinate, - -	26
20. Microscopical Section of Mucous Membrane of Inferior Turbinate, - -	27
21. Path of Air-Stream through Nose, - - - - -	29
22. Electric Lamp with Nernst Burner, - - - - -	35
23. Argand Burner with Mackenzie's Wall Bracket, - - - - -	36
24. Cresswell Baber's Incandescent Spirit Lamp, - - - - -	36
25. Lennox Browne's and Thudichum's Nasal Specula and Method of using, -	37
26. Fränkel's, Duplay's, and a Self-Retaining Wire Nasal Speculum, - -	38
27. Horne's Nasal Probe, - - - - -	39
28. Killian's Speculum for Median Rhinoscopy, - - - - -	39
29. Author's Tongue Depressor, - - - - -	40
30. The Post-Nasal Space, - - - - -	40
31. White's Palate Retractor, - - - - -	41
32. Nasal Cup, - - - - -	43
33. Nasal Irrigator, - - - - -	43
34. Nasal Syringe for Patient's use, - - - - -	44
35. Gottstein's Wool Introducer, - - - - -	44
36. Wool Carrier, - - - - -	44
37. Hovell's Caутery Handle, - - - - -	51
38. Howard's Nasal Bag, - - - - -	54
39. Facies of a Mongol Idiot, - - - - -	59

FIG.	PAGE
40. Deformity of Upper Jaw due to Nasal Obstruction, - - - -	60
41. Deformity of Lower Jaw due to Nasal Obstruction, - - - -	60
42. Diagram illustrating Deformity of Palate produced by Nasal Obstruction, -	61
43. Diagram showing Deformity of Dental Arch produced by Nasal Obstruction, -	61
44. Deformity of Upper Jaw and Teeth in a Child, - - - -	62
45. Deformity of Upper Jaw and Crowded Teeth due to Nasal Obstruction, -	63
46. Deformity of Upper Jaw and Crowded Teeth due to Nasal Obstruction, -	64
47. Diagram showing Formation of Deformed Palate and Nasal Septum resulting from Nasal Obstruction, - - - -	65
48. Diagram showing Formation of Deformed Palate and "Open-Bite" resulting from Nasal Obstruction, - - - -	66
49. Unilateral Facial Paralysis in a Boy age 12, - - - -	67
50. Cast of Upper Jaw from Patient, shown in Fig. 49, - - - -	68
51. Section through frozen Skull to show Space between Tongue and Palate, -	69
52. Deformity of Chest due to Nasal Obstruction, - - - -	72
53. Deformity of Chest due to Nasal Obstruction, - - - -	73
54. Collapse of the Alae Nasi with Method of Operating, - - - -	82
55. Enlarged Venules on Anterior Part of Septum, - - - -	85
56. Diagram of Pain Areas in Nasal Disease, - - - -	89
57. Röntgen-Ray Photograph of Tube in Antrum, - - - -	99
58. Hooks for Removing Foreign Bodies from Nose, - - - -	101
59. Goldsmith's Saw, - - - -	109
60. Bosworth's Saw, - - - -	109
61. Gleason's Operation for Deflected Septum, - - - -	112
62. Killian's Sub-Mucous Resection of Septum, - - - -	115
63. Moure's Operation for Deflected Septum, - - - -	116
64. Moure's Shears, - - - -	117
65. Moure's Malleable Splint, - - - -	117
66. Abscess of Septum, - - - -	123
67. Granular Hypertrophy of Inferior Turbinate, - - - -	142
68. Moriform Hypertrophy of Inferior Turbinate, - - - -	143
69. Panza's Scissors, - - - -	144
70. Carmalt Jones' Spoke-Shave, - - - -	144
71. Author's Snare, - - - -	145
72. Method of Shaping Loop of Snare, - - - -	145
73. Removal of Posterior End of Inferior Turbinate, - - - -	146
74. Removal of Anterior End of Inferior Turbinate, - - - -	147
75. Result of Anterior Turbinectomy, - - - -	147
76. Facies of Atrophic Rhinitis, - - - -	155
77. Microscopical Section of Mucous Membrane in Atrophic Rhinitis, - -	156
78. Lake's Syringe for Paraffin Injections, - - - -	170
79. Nose Distended with Nasal Polypi, - - - -	174
80. Bony Cyst of Middle Turbinate with Polypi attached, - - - -	175
81. Polypoid Mucous Membrane of Middle Turbinate, - - - -	176
82. Nasal Polypi seen by Posterior Rhinoscopy, - - - -	177
83. Microscopical Section of Nasal Polypus, - - - -	178
84. Microscopical Section of Bone in Nasal Polypus, - - - -	181
85. Microscopical Section of Bone in Nasal Polypus, - - - -	182
86. Blake's Snare, - - - -	191
87. Mackenzie's Snare, - - - -	192
88. Krause's Snare, - - - -	192
89. Grünwald's Forceps, - - - -	194
90. Removal of Anterior End of Middle Turbinate (First Stage), - - - -	195

LIST OF ILLUSTRATIONS.

XV

FIG.		PAGE
91.	Removal of Anterior End of Middle Turbinate (Second Stage),	196
92.	Meyer's Ring Curette, - - - - -	196
93.	Depressed Bridge of Nose, Tertiary Syphilis, - - - - -	202
94.	"Nez en Lorgnon," Tertiary Syphilis, - - - - -	203
95.	"Saddle-Back" Nose of Inherited Syphilis, - - - - -	207
96.	Lupus of Nose Perforating Ala, - - - - -	210
97.	Exostosis of Ethmoid projecting into Orbit, - - - - -	222
98.	Exostosis of Ethmoid with Polypus, - - - - -	223
99.	Microscopical Section of Sarcoma of Nose, - - - - -	227
100.	Microscopical Section of Endothelioma of Antrum, - - - - -	230
101.	Microscopical Section of Alveolar Carcinoma of Nose, - - - - -	232
102.	Fibroma of Post-Nasal Space, - - - - -	240
103.	Sphenoidal Sinus with Osteophytic Growths, - - - - -	280
104.	Thrombosis of Cavernous Sinus, - - - - -	282
105.	Electric Lamp for Transillumination of Antrum, - - - - -	301
106.	Transillumination of Antrum, - - - - -	302
107.	Antrum Drill, - - - - -	314
108.	Ellis's Tubes for Antrum, - - - - -	314
109.	Cresswell Baber's Trochar and Cannula, - - - - -	317
110.	Krause's Trochar, Cannula and Conductor, - - - - -	319
111.	Author's Antrum Cannula, - - - - -	319
112.	Radical Operation on Antrum, - - - - -	324
113.	Hajak's Hook and Chisel, and Author's Antrum Knives, - - - - -	326
114.	Röntgen-Ray Photograph of Cannula in Frontal Sinus, - - - - -	338
115.	Tilley's Burr for Enlarging Infundibulum, - - - - -	343
116.	Author's Cannula for Frontal Sinus, - - - - -	344
117.	Killian's Operation on Frontal Sinus, - - - - -	345
118.	Osteomyelitis of Skull, - - - - -	348
119.	Author's Sphenoidal Sinus Forceps, - - - - -	353
120.	Horizontal Section through Anterior Wall of Sphenoidal Sinus, - - - - -	354
121.	Masses of Adenoid Growths removed by Curette, - - - - -	371
122.	Diagram of Posterior Rhinoscopy in Adenoids, - - - - -	376
123.	Beckmann's Curette, - - - - -	379
124.	Juracz's Forceps, - - - - -	380

CHAPTER I.

THE SURGICAL ANATOMY OF THE NOSE AND ITS ACCESSORY SINUSES AND AIR CELLS.

THE nasal fossae are two irregularly-shaped cavities opening in front on to the face by the anterior nares, and behind into the pharynx by the posterior nares or choanae. Each cavity presents a floor, a roof, an inner and an outer wall.

The **floor** is formed by the palatal processes of the superior maxilla and palate bones. It is concave from side to side and wider in the middle than at either extremity.

The **roof** is long, narrow and concave from before backwards. It is formed in front by the nasal bone and fronto-nasal process of the superior maxilla, which slope downwards and forwards; in the middle by the cribriform plate of the ethmoid, which is practically horizontal; and behind by the anterior or under surface of the body of the sphenoid, which slopes downwards and backwards. The thinness of the cribriform plate, the narrowness of the nose in this region (about 2 millimetres), and the concavity of the roof as a whole are well shown in Figs. 1 and 5.

The **inner wall** or **septum nasi** is formed by the thin perpendicular plate of the ethmoid above, by the vomer below, and by the triangular cartilage in front (see Fig. 1). Morell Mackenzie found that the bony septum presented more or less asymmetry in nearly 77 per cent. of over 2000 skulls which he examined with special reference to this point. The triangular cartilage is hardly ever in the median line and is often irregularly thickened. One of the more common irregularities of the septum is a ridge, which commences at the lower and posterior part of the triangular cartilage near the floor of the nose and runs obliquely upwards and backwards towards the sphenoid. It corresponds in position to, and represents an abnormal thickening of, the processus sphenoidalis of the triangular cartilage (see Fig. 1). Thickenings and deflections of the septum are almost limited to its anterior two-thirds and to its lower part: the posterior third is usually in the median line, and the posterior choanae are of equal size. Though some septal irregularities are

undoubtedly traumatic, the great majority are probably developmental. They may be found in quite young children (in 16 per cent. according to Anton¹), and even in the embryo, but most often become marked at about the 10th-12th year or later, when the rapid development of the face and upper jaw is in progress. This subject will be fully discussed in Chapter VII, where additional statistics will be found. According to Zuckerkandl congenital apertures may occasionally be found in the bony septum.

The **outer wall** of the nose is formed chiefly by the inner surface of

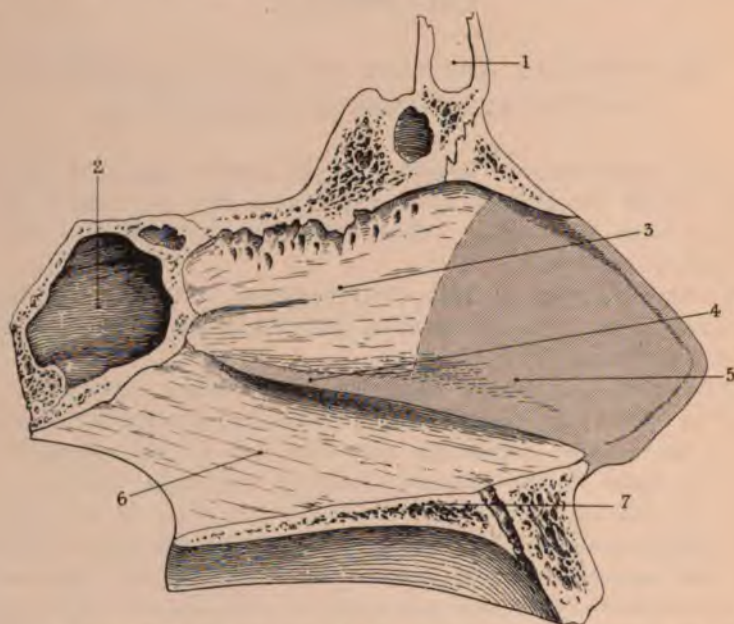


FIG. 1.—THE NASAL SEPTUM. 1, Frontal sinus; 2, sphenoidal sinus; 3, perpendicular plate of the ethmoid; 4, processus sphenoidalis of the triangular cartilage; 5, triangular cartilage; 6, vomer; 7, hard palate. The thickened ridge at the junction of the vomer with the processus sphenoidalis is well shown.

the body of the superior maxilla, the inferior turbinate, the lateral mass of the ethmoid, the vertical plate of the palate bone and the internal pterygoid plate of the sphenoid. This wall is most important from a surgical standpoint and merits detailed study. From it project three horizontal ridges, the inferior, middle and superior turbinates, which divide the nasal cavity into four passages, namely, the inferior meatus, lying between the inferior turbinate and the floor of the nose; the middle meatus, between the middle and inferior turbinates; the superior meatus, between the middle and superior turbinates; and the fourth or highest meatus, sometimes called the spheno-ethmoidal recess, between the superior

¹ *Arch. für Ohrenheilk.*, 1893, xxxv. p. 305.

turbinate and the roof of the nose (see Figs. 2, 4 and 5). In front of the turbinates the outer wall of the nose is smooth: its lowest and most anterior part is lined by skin continuous with that of the face, and forms the outer wall of the vestibule. Behind and above the vestibule and on a level with the entrance to the middle meatus of the nose is a smooth triangular area of mucous membrane known as the atrium of the middle meatus (see Fig. 2). Occasionally a slight elevation is found in the atrium near the anterior end of the middle turbinate. This is

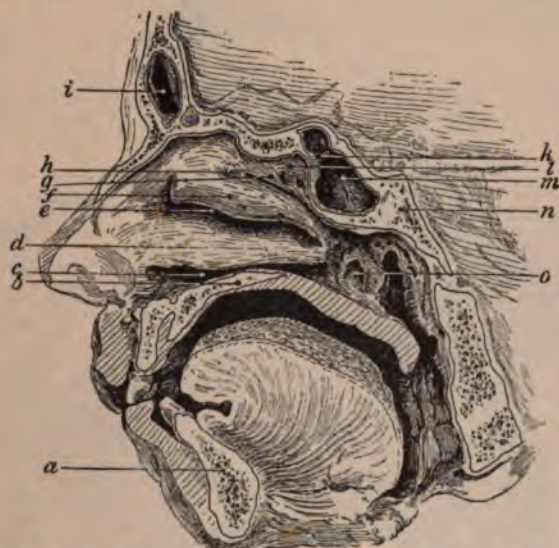


FIG. 2.—VERTICAL ANTERO-POSTERIOR SECTION OF THE HEAD PASSING THROUGH THE RIGHT NASAL FOSSA IMMEDIATELY TO THE OUTER SIDE OF THE SEPTUM.
a. Lower jaw; *b.* hard palate; *c.* inferior meatus; *d.* inferior turbinate; *e.* middle meatus; *f.* middle turbinate; *g.* superior meatus; *h.* superior turbinate; *i.* frontal sinus; *k.* posterior ethmoidal cell; *l.* fourth or highest meatus; *m.* sphenoidal sinus; *n.* body of the sphenoid; *o.* Eustachian tube.

known as the agger nasi, and constitutes the remains of the large nasal turbinate of the carnivora.

The **inferior turbinated** body is about 40 to 50 mm. long, and 12 to 15 mm. in width near the centre, its widest part. It tapers rapidly towards both extremities: the anterior end is more rounded and larger than the posterior. On transverse section near its central part the inferior turbinate is seen to be markedly curved, and to consist of a horizontal and a vertical limb (Fig. 5). In the adult the lower edge lies 3-4 mm. above the floor of the nose; in the new-born it is almost in contact (Fig. 8).

The **inferior meatus** of the nose is small in front, smaller still behind, and much more roomy in the centre, owing to the strong outward bend of the outer wall of the nose and the curved line of attachment of the inferior turbinate. The average length of the inferior meatus is 60-65 mm., though according to Thane, it may attain 73 mm. The width of

the inferior meatus measured from the septum to the outer wall of the nose, near its central part, is 12-18 mm.; the height is about 20 mm. At the highest part of the meatus and under the inferior turbinate, about 25 mm. behind the entrance to the nose, is the orifice of the

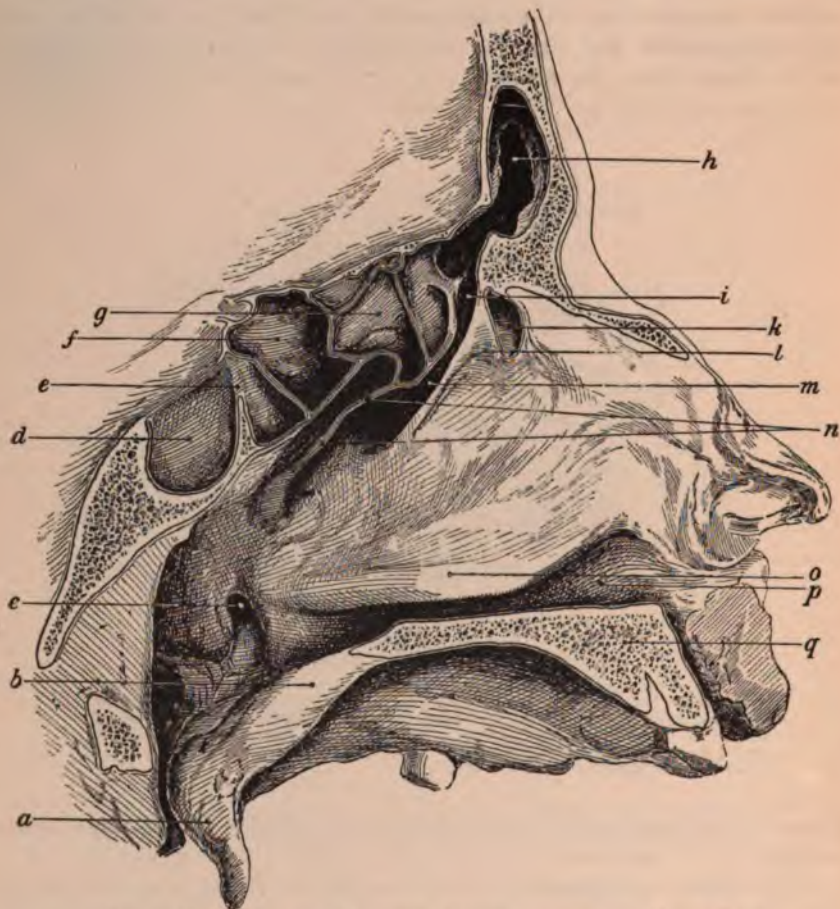


FIG. 3.—VERTICAL ANTERO-POSTERIOR SECTION THROUGH THE NASAL FOSSA SOMEWHAT TO THE LEFT OF THE MIDDLE LINE. The middle turbinate has been removed and a dissection made to expose the structures on the outer wall of the nose. *a*. Uvula; *b*. soft palate; *c*. Eustachian tube; *d*. sphenoidal sinus; *e*. ostium of the sphenoidal sinus; *f*. posterior ethmoidal cell; *g*. middle ethmoidal cell; *h*. frontal sinus; *i*. infundibulum; *k*. a window cut in the uncinat process to show the fossa on its outer side; *l*. uncinat process; *m*. hiatus semilunaris; *n*. attachment of the middle turbinate; *o*. inferior turbinate; *p*. inferior meatus; *q*. hard palate.

nasal duct, which is often marked by a small crescentic fold of mucous membrane (Fig. 6).

The shape of the inferior meatus is of some surgical importance, for the width of the air-way may be greatly increased by simply removing the anterior extremity of the inferior turbinate and thus allowing free access

to the larger middle part of the meatus. Upon this observation is based the operation of anterior turbinectomy.

The **middle turbinate** varies from 30-40 mm. in length and is 15 mm. in height in its largest part. Arising from the lateral mass of the ethmoid it curves inwards, downwards, and finally outwards. Its line of attachment, as shown in Figs. 3 and 15, consists of an anterior hook-shaped part and a posterior nearly horizontal part. Under the anterior hook-shaped part, the middle meatus bulges upwards and forms a cavity known as the recessus meatus medii which approaches closely to the floor of the frontal sinus. The free border of the middle turbinate is often thickened,



FIG. 4.—VERTICAL TRANSVERSE SECTION THROUGH THE NASAL FOSSA IN THE PLANE OF THE OPTIC NERVES AND THE THIRD MOLAR, VIEWED FROM THE FRONT. *a.* Optic nerve; *b.* superior turbinate; *c.* middle ethmoidal cell; *d.* septum; *e.* middle meatus; *f.* ostium of the maxillary antrum; *g.* middle turbinate showing a cell; *h.* maxillary antrum; *i.* inferior meatus; *k.* inferior turbinate.

especially at its anterior extremity, where a small air-cell may be found. Lothrop found this cell present in 18 per cent. of his specimens, but in 6 per cent. it was quite small. Harmer stated that the cell was commonly present and that it was lined with normal mucous membrane similar to that of other ethmoidal cells. In disease the cell may become greatly distended. The anterior border of the middle turbinate commonly runs vertically downwards and joins the horizontal border at a well-marked angle, thus forming the lobulus, or operculum meatus medii (see Fig. 2). Occasionally the middle turbinate is partially divided into two by a slight horizontal furrow which is most marked posteriorly.

The removal of the middle turbinate brings into view the uncinate process, the hiatus semilunaris, the bulla ethmoidalis and the openings of the infundibulum, of the maxillary antrum and of some of the anterior ethmoidal cells (Fig. 3).

The **uncinate process** is a narrow shelf on the outer wall of the nose, broadest in front, and gradually tapering behind. It arises in front from the anterior portion of the lateral mass of the ethmoid in close proximity to the upper part of the anterior border of the middle turbinate. It thence passes downwards and backwards parallel to the bulla ethmoidalis, ending just below and behind the maxillary ostium. It is slightly curved, with its concavity upwards. The inner convex surface looks downwards, inwards and forwards. The external concave surface looks outwards, upwards and backwards, and forms the lower border of the hiatus semilunaris (see Figs. 3 and 5).

The **bulla ethmoidalis** is a smooth rounded eminence lying just above the

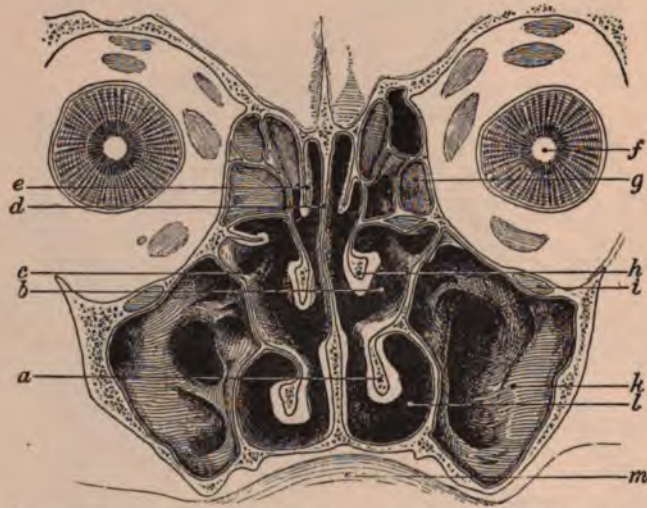


FIG. 5.—VERTICAL TRANSVERSE SECTION OF THE NOSE, IN THE PLANE OF THE EYEBALLS AND SECOND MOLARS, VIEWED FROM BEHIND. *a*. Inferior turbinate; *b*. middle fossa; *c*. uncinate process; *d*. nasal septum; *e*. superior turbinate; *f*. pupil; *g*. middle ethmoidal cell; *h*. middle turbinate; *i*. infra-orbital vessels and nerve; *k*. cavity of the antrum; *l*. inferior meatus; *m*. hard palate.

uncinate process, and extending upwards to the attached border of the middle turbinate. It is formed by the projection of one or more of the larger middle ethmoidal cells, and varies greatly in size, according to the degree of development of these cells (see Fig. 3).

Between the bulla ethmoidalis and the uncinate process is a long, narrow, half-moon-shaped cleft, the **hiatus semilunaris**. It is 15–20 mm. long and about 3–4 mm. in width. Its anterior end, which is deepest, reaches up into the recessus meatus medii: its posterior part gradually shallows away. Into this cleft open the infundibulum in front, the ostium maxillare near its posterior end, and some of the anterior ethmoidal cells, usually near the anterior end. These openings are entirely concealed from view until the uncinate process has been removed. From this anatomical arrangement it will be seen how easily swelling of the mucous membrane,

which is very loosely attached in this region, will occlude the openings of the cavities: and further that it will be very difficult, or quite impossible in most instances, to catheterize the sinuses through the ostia in the living subject.

The **superior turbinate** is a small thin projection situated far back and high up in the nose. It is usually 5-6 mm. long, but may attain the

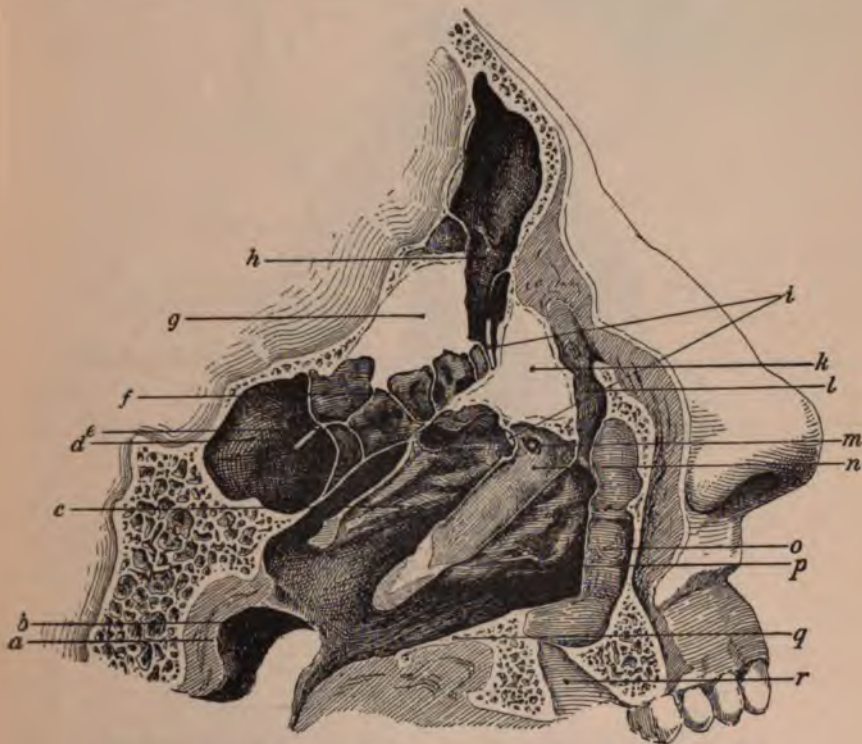


FIG. 6.—VERTICAL SECTION OF THE NOSE BEGINNING IN THE BODY OF THE SPHENOID, NEAR THE MIDDLE LINE, AND PASSING OBLIQUELY FORWARDS THROUGH THE OUTER WALL OF THE NOSE AND THE ORBIT. Viewed from the outer side. Part of the inner wall of the orbit and of the inner wall of the antrum have been subsequently cut away to show the infundibulum, the ethmoidal cells, and the large concavities under the middle and inferior turbinates. *a*, Post-pharyngeal wall; *b*, posterior margin of the nasal septum; *c*, outer surface of the middle turbinate; *d*, sphenoidal sinus showing a probe inserted into its ostium; *e*, posterior ethmoidal cells; *f*, middle ethmoidal cells; *g*, inner wall of the orbit; *h*, position of ostium of frontal sinus surrounded by anterior ethmoidal cells; *i*, probe passed down the infundibulum into the middle meatus; *k*, inner wall of the orbit; *l*, lachrymal duct; *m*, ostium of maxillary antrum; *n* and *o*, parts of inner wall of antrum; *p*, large external surface of inferior turbinate; *q*, hard palate; *r*, socket of first molar tooth showing its proximity to floor of antrum.

length of 15 mm. Under normal conditions it can be seen by posterior, but not by anterior, rhinoscopy.

The **superior meatus** is a mere short slit into which the posterior ethmoidal cells open, generally by one or two roundish ostia.

The **fourth** or **highest meatus**, sometimes called the spheno-ethmoidal recess, is the space above and behind the superior turbinate and below

the sphenoidal—the highest of the turbinate processes. Into it open the sphenoidal sinus and, occasionally, one of the posterior ethmoidal cells.

Above and behind the superior turbinate, and below the sphenoidal turbinate, may occasionally be seen a small ridge, the rudimentary remains of a fourth turbinate. According to Zuckerkandl a trace of this may be

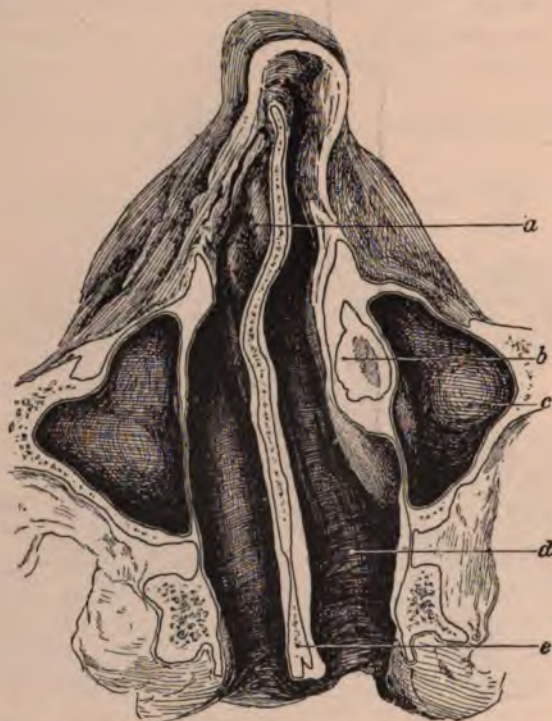


FIG. 7.—HORIZONTAL SECTION OF THE NOSE ABOUT HALF AN INCH ABOVE ITS FLOOR, VIEWED FROM ABOVE. On the left side the inferior turbinate has been entirely removed to show the antro-meatal septum. *a*. Large spur on the septum; *b*, inferior turbinate; *c*, cavity of the antrum; *d*, floor of nose; *e*, septum.

seen in 8 per cent. of adults' skulls, whilst in infantile and foetal life it is almost constantly present.

The **dimensions of the nasal cavity** are largest near its centre. The height in this region is about 44 mm. (Thane), the width near the floor 12–18 mm., and the width of the roof 2–3 mm. The length of the nose along the inferior meatus varies from 60–70 mm. The posterior choanae vary somewhat in size, averaging 20–25 mm. in height by 16 mm. in breadth. Zuckerkandl stated that the choanae were always equal in size, but Bergeat,¹ who examined 1200 skulls with special reference to this point found slight asymmetry in 10 per cent. He concluded that this

¹ Bergeat, *Archiv für Laryngol.*, 1896, iv, p. 409.

was developmental, as it was never found at birth. Citelli,¹ from an examination of 1,025 skulls, concluded that the average height was 24 mm., average width 12 mm., and that slight asymmetry was frequent.



FIG. 8.—VERTICAL SECTION THROUGH THE NOSE OF AN INFANT. (Natural Size.)
1, The antrum; 2, inferior meatus; 3, inferior turbinate; 4, orbit; 5, unerupted teeth.
The mucous membrane is shrunk, making the nasal passages appear unusually roomy.

Development of the Nose. The nose may be divided into two regions, an ethmoidal and a maxillary, and great differences exist in the relative size of these parts at various stages of development. In



FIG. 9.—VERTICAL SECTION THROUGH THE NOSE OF A SIX YEAR OLD CHILD.
(Natural Size.) To show the Development of the Antrum. 1, Orbit; 2, antrum;
3, middle meatus; 4, inferior turbinate; 5, temporary molar; 6, permanent tooth;
7, junction of the septum and hard palate.

infancy, corresponding to the small development of the face as compared to that of the skull, the ethmoidal portion of the nose is

¹ Citelli, *Journal of Laryngol.*, 1903, xviii. p. 219.

comparatively larger than the maxillary. At birth the ethmoidal region is double the height of the maxillary region, this difference gradually diminishing until, at the seventh year, the two portions become of about equal height as in adult life. In childhood also the longitudinal section of the nose is relatively smaller, as compared to the transverse section, than in adults. At about the sixth year, as the alveolar border, which is to contain the three molar teeth, develops, the upper jaw becomes pushed forward to make room for it, and the nose at the same time increases in length, attaining its full development about the twentieth to twenty-fifth year, corresponding to the eruption of the wisdom teeth. In infancy the inferior meatus is low and narrow, and the lower border of the inferior turbinate is in contact with the floor of the nose, so that the middle meatus alone is free for respiration. At the third year, after the first dentition, the inferior meatus begins to develop, but remains very narrow until after the seventh year. This late development of the inferior meatus and upper jaw helps to explain the serious results which may follow nasal catarrh and obstruction in the early years of life.

THE ACCESSORY SINUSES.

The **accessory sinuses and air cells of the nose** are divided into two sets according to the position of their openings: the cavities opening into the middle meatus of the nose, viz. the maxillary antrum, the anterior



FIG. 10.—SHOWING THE RELATIONS OF THE ACCESSORY SINUSES TO THE SURFACE. The anterior walls of the frontal sinuses, part of the roof and outer wall of the orbit, and the outer walls of some of the ethmoidal cells and of the maxillary antrum have been removed. *a.* The maxillary antrum; *b.* nasal fossae; *c.* middle ethmoidal cells; *f.* frontal sinus.

ethmoidal cells, and the frontal sinus, are known as the anterior set; and the cavities opening above the attachment of the middle turbinate, viz. the posterior ethmoidal cells and the sphenoidal sinus, as the posterior set.

The **maxillary antrum**, the largest of the accessory sinuses of the nose, is situated in the body of the superior maxilla. It is irregularly pyramidal in shape, the apex being formed by the malar process and the base by the outer wall of the nose.

The **inner wall** separates the antrum from the inferior meatus of the nose below and from the middle meatus of the nose above, being traversed on its nasal aspect by the attachment of the inferior turbinate. It is slightly convex towards the antrum from above downwards, and very markedly so from before backwards. It consists of thick and dense bone where it joins the nasal floor, and the anterior angle formed by the junction of the inner and anterior walls is a specially strong buttress of bone, but it rapidly diminishes in thickness as it passes upwards and backwards, and the greater part of the inner wall is very thin. Near the maxillary ostium the bone is often defective in places, the openings being filled merely by membrane. At the extreme upper part of the inner wall the antrum communicates with the nose through the posterior end of the hiatus semilunaris by a small rounded or oval opening. In the skeleton this opening is large and irregular, but in the natural state it is partially closed by membrane, and varies in size from 6-10 mm. long and 2-6 mm. in vertical breadth. Occasionally it takes the form of a long narrow slit. The position of the opening concealed by the uncinate process renders catheterization of the sinus through the anterior nares exceedingly difficult, and generally impossible.

Below the posterior end of the uncinate process and between it and the upper edge of the inferior turbinate may be seen in some 10 per cent. of cases one, or occasionally two, accessory openings leading directly into the antrum. These openings are usually circular and larger than the normal ostium. In the upper and anterior part of the inner wall runs the nasal duct, forming a rounded projection in the antral cavity.

The **floor of the antrum** is formed by the alveolar border of the superior maxilla and comes into close relationship with the teeth, especially with the molars. The roots of the first molar, and occasionally also of the adjacent teeth, may protrude into the antrum as small conical projections on its floor, and are separated from the cavity merely by a very thin plate of bone or, occasionally, by membrane only. As the antrum extends forward it comes into relation with the bicuspid teeth, the roots of which however are generally separated from the cavity by a considerable thickness of bone. Rarely the antrum may extend as far forwards as the canine tooth. The level of the floor of the antrum as compared with the floor of the nose varies. It is said to be generally on the same level in men, and lower in women, but this difference is extremely doubtful. Its posterior part is usually on a higher level than the floor of the nose.

The **anterior or outer wall** of the antrum corresponds externally to the canine fossa, a depression extending from the ridge formed by the socket

of the canine tooth in front to the malar bone behind. The bone forming it is usually thin, but may be 2 millimetres thick. It is never so thin as that forming the inner wall, and is therefore not so easy to puncture with a trochar. When the canine fossa is deeper than normal, it is probable that the antrum will be proportionately smaller and not extend so far forward.

The **roof** of the antrum, which separates it from the orbit, is a thin plate of bone. In it runs the canal for the infra-orbital vessels and nerve, and near the ethmoidal border it may contain part of an ethmoidal cell. (Logan Turner.) The **posterior wall** which separates the antrum from the zygomatic fossa is very thin and of no surgical importance. Both these walls may show congenital perforations. The **apex** of the antrum, where the malar bone articulates with the maxilla, is very thick and strong.

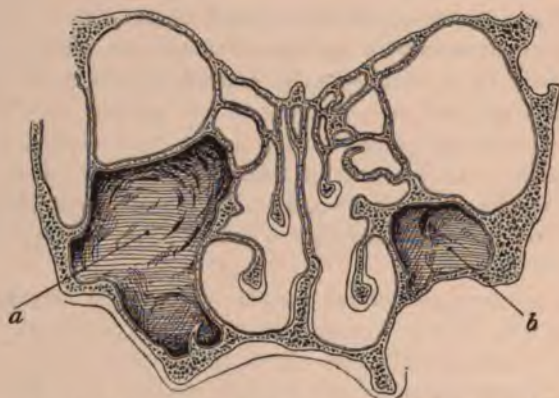


FIG. 11.—A SEMI-DIAGRAMMATIC FIGURE SHOWING ASYMMETRY OF THE ANTRAL CAVITIES. *a.* Normal antrum; *b.* extremely small antrum which it would be impossible to puncture from the alveolar process and extremely difficult to do so from the inferior meatus.

The **cavity** of the antrum varies much in size. On an average the largest diameters are about 35 millimetres vertical, 25 transverse and 32 antero-posterior. In my experience these cavities are generally symmetrical, a small antrum on one side corresponding to a small one on the other. Ziem and Zuckerkandl state that the antrum may be limited to a mere slit, or to a rounded cavity lying opposite the middle meatus of the nose, its lower part, corresponding to the inferior meatus, being entirely undeveloped. Some clue to this rare state of affairs may usually be gained by external examination. In the slighter cases there may only be an unusually deep canine fossa; in the more marked I have found in addition to a deep canine fossa an extremely high-arched palate and a narrow, high alveolar border (see Fig. 11). If this ill development be limited to one side the face will probably be asymmetrical. These small sinuses may give rise to great difficulties both in the diagnosis and treatment of antral disease. They are dark to transillumination owing to

the density of the bone, and it may be impossible to reach them either by drilling through the alveolar margin or by puncture through the inferior meatus of the nose.

In my clinical experience these small cavities have only been met with in association with a thin narrow face. Macdonald states that the antrum is often small in cases of atrophic rhinitis, and certainly in these cases the outer wall of the inferior meatus of the nose may seem to curve more outwards, but the loss of width thus produced is more than compensated for by increased width of the face.

The interior of the antrum is often more or less divided up by bony septa and membranous folds. Zuckerkandl states that it may be divided into two separate cavities, but this is extremely rare. I have one specimen showing such a condition, and Logan Turner has once met with an almost complete septum. Grüber¹ has found five complete divisions in two hundred specimens. Cryer regards these second cavities as ethmoidal cells. Frequently the septa are so large that their removal is required to obtain free drainage in cases of suppuration. The antral cavity may also be irregularly enlarged by a local bulging out of its walls in almost any direction. The ridge of bone carrying the infraorbital vessels and nerve almost constantly cuts off a part of the antrum in its upper and inner part, thus forming the infraorbital cell (Cryer).

Development of the Antrum. The antrum is present as a very small slit-like cavity at birth, being 1-3 mm. in height by 7 mm. in antero-posterior diameter. It gradually increases in size as the eruption of the milk teeth proceeds. At six years it forms a more or less round cavity lying opposite the middle meatus of the nose, measuring 5-8 mm. in diameter, and extending outwards beneath the orbit as far as the infra-orbital canal. It is separated from the hard palate and alveolar process by a mass of cancellous bone in which lie the germs of the permanent teeth (see Fig. 9). This general arrangement continues until the eruption of the permanent teeth, that is until about the seventh year, when the cavity commences to extend downwards towards the hard palate and alveolar process, gradually attaining its pyramidal shape and adult dimensions with the complete development of the upper jaw.

The structure of the upper jaw at the seventh year, consisting mainly of a large mass of cancellous bone, is well shown in Fig. 9. The development of the antrum has an important surgical significance, especially in reference to certain conditions which have been described as *empyemata* of the maxillary antrum occurring at early ages. These are really cases of osteomyelitis of the upper jaw, the true pathology of which has been completely misunderstood (see Chap. XVIII). It is also necessary to bear in mind the development of the upper jaw in order to understand the irregularities in its formation produced by obstruction to nasal respiration (see Chap. IV).

¹ Quoted by Turner.

Frontal Sinus. The frontal sinus is formed by the separation of the inner and outer tables of the frontal bone in the supra-orbital region, and consists of a vertical portion extending upwards on to the forehead, and a horizontal portion extending backwards over the orbit. It is an irregular, pyramidal cavity, with its apex at its highest point in the frontal bone, its base formed by the roof of the orbit, and with three walls, an anterior, a posterior, and an internal. The last-named wall separates the two frontal sinuses, and is consequently often termed the sinus septum (see Fig. 10).

The **anterior wall** is convex outwards, both from above downwards and from side to side. Its thickness varies considerably in different skulls, ranging from 2-6 mm. It is often stated, and the statement is emphasized, that this wall contains no diploë, or that traces at most are present; but repeated observations have convinced me that diploic tissue is constantly present, although often in small amount (see Fig. 14).

The **posterior wall** is usually very thin, $\frac{1}{2}$ -1 mm. in thickness, and is composed of dense brittle bone with no cancelli. It is convex towards the sinus. Its posterior surface is indented by the convolutions of the frontal lobe of the brain.

The **internal wall**, or sinus septum, is very thin, but almost always complete. In one hundred and four skulls Tilley found it complete in all. Lothrop saw it perforated only twice in one hundred and eighty specimens. Turner found it always complete, and Bosworth is evidently in error when he states that the sinuses frequently communicate. In cases of suppuration, however, the septum may become perforated, and this is probably not very rare. I have three times seen this; and Luc, Tilley, and others have recorded a similar condition. The lower part of the septum is usually in the middle line: as it extends upwards it may be very deflected, or become almost horizontal. If in a skull such as that shown in Fig. 12, an attempt had been made to perforate the right frontal sinus above the supra-orbital margin, although the opening was made well to the right of the median line, it would have been quite possible to have opened the left frontal sinus. In rarer cases the septum is twisted so that one cavity may partially overlap the other.

The **inferior wall** consists of a large outer or orbital portion forming the roof of the orbit, and a small inner or nasal portion forming the roofs of some of the anterior ethmoidal cells. The orbital portion is very thin, is convex towards the sinus, and internally bends abruptly downwards to join the lamina papyracea of the ethmoid. It is perforated by a small vein near its inner end. The nasal portion of the floor is a small irregular surface composed of very thin bone separating the sinus from a variable number of anterior ethmoidal cells. The inferior wall of the frontal sinus is the thinnest, and is consequently the commonest seat of perforation or bulging, which often occurs in the neighbourhood of the small vein above mentioned. It is here also that tenderness on pressure should be sought

for. It is probable that the nasal portion of the floor is often perforated in disease of the sinus.

Size of Cavity. The frontal sinuses vary much in size. They may be very large and extend outwards as far as the external angle of the orbit, upwards for one, two, or even two and a half inches, and backwards to the posterior part of the roof of the orbit. Turner gives as an average measurement: Height 31.6 mm., breadth 25.8 mm., and depth, measured along the roof of the orbit, 18 mm. The depth behind the supra-orbital margin is much



FIG. 12.—ASYMMETRY OF THE FRONTAL SINUSES. The left frontal sinus is abnormally large and extends right across the middle line. The right frontal sinus is a small cavity at the inner angle of the orbit.

less, averaging 4–8 mm. The frontal sinuses may be very small; they may be limited to small cavities situated at the internal angle of the orbit, the vertical portions being missing; occasionally both sinuses are entirely absent. The sinuses are frequently asymmetrical, a large cavity on one side being associated with a small one on the other: or only one cavity of a variable size may be found. A single large sinus may extend from one supra-orbital region to the other; the true nature of the cavity will be indicated by the presence of a single ostium communicating with only one nostril. Lothrop in two hundred and fifty specimens found both sinuses invariably present in the orbital region,

but in 3 per cent. the vertical portion was absent. He, however, describes one specimen with a large sinus on one side and apparently none on the other.¹ Logan Turner, in two hundred and forty European skulls, found one or both sinuses absent in forty-one; that is in 17 per cent. Of these, in eighteen, that is in 7.5 per cent., both sinuses were absent, and in twenty-three, or 9.5 per cent., one sinus was absent. Tilley² found entire absence of the sinuses twice in 120 skulls, in one case in association with prominent brows. Kicer³ found both sinuses absent five times, and one sinus absent seven times in 195 skulls. Max Scheier⁴ found no frontal sinus twice in 100 skulls. On the whole, the sinuses seem to be larger in males than in females, and are smaller and more often absent in races with receding foreheads; but the size of the cavity bears no constant relation to the prominence of the supra-orbital area.

In the living body two means may be adopted to ascertain the existence of sinuses—transillumination and the Röntgen rays. Of these the latter is the more reliable: when the sinuses are large their presence can be definitely determined, both by the screen and by photography, but if the sinuses are small, these means may fail. The results of transillumination are very uncertain. Unless a definite cavity can be demonstrated by means of the Röntgen rays, external operation alone can decide its presence or absence.

As in the antrum, bony and membranous ridges partially dividing the cavity are often found: they usually run in a vertical and antero-posterior direction. Very rarely there is a complete septum dividing a sinus into an inner and an outer part, but usually although it may appear complete, there is an opening at the lower part, so that both divisions of the sinus open into the nose through one ostium. Another condition simulating a double frontal sinus is the presence of a large ethmoidal cell extending well outwards over the orbit. One or two cells are normally present near the nasal floor of the sinus, and in rare specimens a cell as large as the frontal sinus itself may be found, and its true nature may be easily overlooked. Instances of true double frontal sinus are recorded by Scheier, Hansen, Pluder, etc., and I possess one specimen showing it on both sides.

The frontal sinuses may have various diverticula or recesses, especially near the outer angle, or there may be a prolongation from the inner end of the sinus into the crista Galli. According to Cryer, the latter is found in 10 per cent. of specimens. These recesses are of considerable surgical importance, as they may be easily overlooked during operations: suppurating foci may be left behind and the operation may prove a failure.

¹ *Annals of Surg.*: 1898, xxviii. p. 622.

² *Lancet*, 1896, ii. p. 867.

³ *Laryngoscope*, 1899, vi. p. 83.

⁴ *Archiv für Laryngol.*, 1902, xii. p. 296, and *Archiv Internat. de Laryngol.*, 1901, xiv. p. 321.

Development. The frontal sinuses are absent at birth, and up till about the sixth year. They apparently begin to develop as a protrusion from the ethmoidal region at about the sixth or seventh year, and slowly spreading between the tables of the frontal bone, attain their full size and dimensions at or about the age of puberty. From nine to twelve years old fair-sized cavities have been seen (Symington).¹

Relations. The most important of the external relations of the frontal sinuses are as follows: The outer part of the inferior wall forms the roof of the orbit, and at its inner end is a small depression in which is fixed the pulley of the superior oblique muscle. The attachment of this pulley is often necessarily displaced in operations on the sinus. The anterior margin is crossed at its inner end by the supra-trochlear vessels and nerve, which are necessarily divided in operations, but are of no great importance.



FIG. 13.—A DISSECTION SHOWING THE EXTERNAL RELATIONS OF THE FRONTAL SINUS. The right frontal sinus and infundibulum have been opened from the front. On the left side a skin flap has been turned back to show the position of the pulley of the superior oblique. *a.* Lachrymal duct; *b.* commencement of the infundibulum; *c.* nasal septum; *d.* pulley of the superior oblique; *e.* cavity of the frontal sinus; *f.* line of incision in the supra-orbital margin; *g.* tendon of the superior oblique.

If the sinus extends far outwards the supra-orbital vessels and nerve also come into relation with its anterior wall (see Fig. 13).

The posterior wall is in relation with the dura mater and frontal lobe of the brain for the greater part of its extent, and with the olfactory lobe at its inner border.

The **ostium** of the frontal sinus is in the posterior part of the nasal portion of the floor, near the septum; being placed at the most dependent part of the cavity, it is well situated for drainage. It is round or oval, averaging 3 mm. in diameter, but varying from 2-8 mm. It leads into the infundibulum, a long curved canal (15 mm.) running downwards and backwards to the anterior end of the hiatus semilunaris. This canal is convex forwards and downwards; it is bounded below by the uncinat process and the bulla ethmoidalis, and above by the anterior ethmoidal cells and the lachrymal bone. The canal may be wide and nearly straight, or

¹ *The Anatomy of the Child.* Edinb. 1887.

tortuous and narrow; its upper end is generally somewhat dilated. This is the commonly described arrangement, but very frequently (according to Lothrop in 50 per cent. of skulls), the frontal sinus opens directly through a short straight canal into the uppermost part of the middle meatus, and not into the hiatus semilunaris at all. In this case the infundibular canal terminates in an anterior ethmoidal cell (see Fig. 14). Some authors, *e.g.* Logan Turner, define the infundibulum as the cavity lying between the uncinate process and the bulla ethmoidalis, in which case the hiatus semilunaris means only the narrow slit-like entrance to this cavity. The upper closed-in part of the duct leading to the frontal sinus, which I have designated the infundibulum, is called by Turner the naso-frontal canal. The terminology I have adopted is the older, and there seems no good reason for altering it.

These considerations show the great difficulty of **catheterizing** the frontal sinus from the nose, a problem which has been much debated. Jurasz succeeded in introducing a probe eleven times in twenty-one cases, six times after considerable difficulty. Hansberg¹ introduced a special very fine probe, bent at an angle of 135° about 30 mm. from its distal end; with this he claimed to enter about half the sinuses on the cadaver. Winckler² was successful in about one-fifth of his cases. Max Scheier was successful five times in thirty skulls, controlling his observations with the Röntgen rays.³ Zuckerkandl, after numerous experiments, concluded that the proceeding was attended with great difficulty and uncertainty, and the majority of observers agree with this opinion. On the other hand, Lichtwitz succeeded in entering ten out of thirteen sinuses on the cadaver, using a probe bent at a right angle about one inch from the end. Kicer⁴ passed a probe successfully in 48 per cent. of 195 skulls. Lothrop, in an examination of 250 skulls with reference to this point, found that he could pass a probe into the sinus in about 25 per cent. Where a long infundibular canal led from the ostium frontale to the hiatus semilunaris probing was always impossible. Only when the infundibulum was a short, straight canal opening directly into the middle meatus, could probing be carried out.

In 25 skulls in which the nose was opened by antero-posterior section, I found it possible to reach the sinus with a probe in only 6. Glätzel,⁵ controlling his observations by means of the X-rays, came to the conclusion that in many apparently successful results on the living, the probe was actually lying in an ethmoidal cell.

The chief obstructions to the passage of the probe arise from: 1. The middle turbinate, which entirely conceals the approach to the infundibulum. Before making an attempt to probe the frontal sinus, the anterior end of

¹ *Monatschr. für Ohrenheilk.*, 1890, xxiv. pp. 3, 43.

² *Archiv für Laryngol.*, 1894, i. p. 178.

³ *Journal of Laryngology*, xiii. p. 201.

⁴ *Laryngoscope*, 1899, vi. p. 85.

⁵ *Archiv für Laryngol.*, 1900, xi. p. 155.

this body should therefore be removed. 2. The uncinatè process. When this process is prominent, and the infundibulum opens into the upper part of the hiatus semilunaris, probing is obviously impossible until it has also been removed. 3. The bulla ethmoidalis. When large it may encroach upon and considerably narrow the hiatus semilunaris. 4. The small calibre

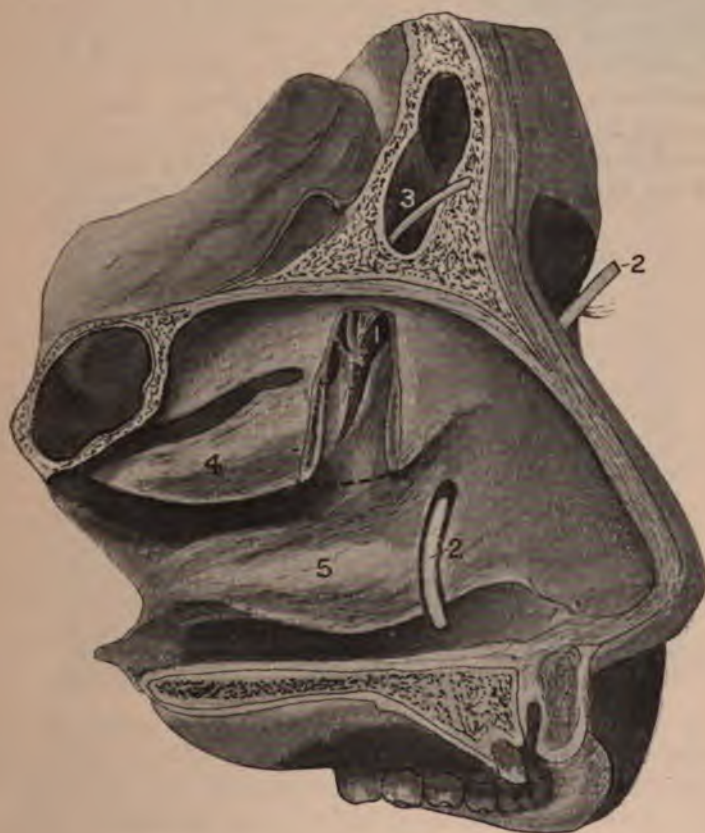


FIG. 14.—ANTERO-POSTERIOR SECTION THROUGH THE NOSE. Showing the frontal sinus opening into the middle meatus instead of into the infundibulum. 1, Infundibulum, which terminates in an ethmoidal cell; 2, probe in nasal duct, part of the inferior turbinate having been cut away; 3, frontal sinus showing probe in the duct leading into the middle meatus; 4, middle turbinate; 5, inferior turbinate.

or tortuous curve of the infundibulum. 5. The ostia of the ethmoidal cells, into which the probe is very liable to pass. As these usually open into the *outer* side of the infundibulum, they may be avoided by keeping the point of the probe close to the median line; but even then an occasional median ethmoidal cell may exist, the ostium of which can hardly be avoided.

During life the existence of these obstructions can never be certainly

recognised on account of the inaccessibility of the region under consideration, even after complete removal of the anterior extremity of the middle turbinate. If, then, the uncertainty of probing the sinus be great on the cadaver, how much greater it must be during life.

In disease, however, the conditions are often altered, the bony obstructions are broken down, and the infundibular canal is greatly enlarged. Formerly the only test that the probe had actually entered the frontal sinus consisted in observing its direction, and in measuring the distance it had passed into the nose, whilst now its exact position can be ascertained with considerable certainty by means of the Röntgen rays. This subject will be again discussed (see Chap. XXI.).

The **ethmoidal cells** are situated in the lateral masses of the ethmoid bone, above and external to the middle turbinate. They are bounded



FIG. 15.—SEMI-DIAGRAMMATIC SECTION OF A SMALL PORTION OF THE FRONTAL BONE, SHOWING A LARGE ETHMOIDAL CELL BEHIND THE FRONTAL SINUS. 1, Ethmoidal cells; 2, frontal sinus (after Onodi).

above by the cribriform plate, and externally by the orbital plate. The majority of the cells are entirely in the ethmoid, but some are completed by the neighbouring bones—the frontal, lachrymal, and superior maxilla. The cells vary in size and number, and are never symmetrical. Generally speaking they are larger below and behind; smaller and more numerous above and in front. They may be divided into two groups, a posterior and an anterior.

The **posterior** group consists of one, two, or even four large cells which open into the nose above the middle turbinate, that is, into the superior meatus. The cells may open into a common cleft-like ostium in the most dependent position, or have separate round or oval openings placed at some distance above their floors.

The **anterior ethmoidal** cells form a group of four to six or more cells, which open into the middle meatus of the nose either high up under the middle turbinate, or into the infundibulum, or hiatus semilunaris. Some small cells belonging to this group, lying around and opening into the

infundibulum, are sometimes known as the fronto-ethmoidal cells. Occasionally one or more cells may extend out over the roof of the orbit under or behind the frontal sinus (see Fig. 15). One or two of the larger anterior ethmoidal cells form the prominent, rounded eminence projecting into the middle meatus above the hiatus semilunaris, known as the bulla ethmoidalis.

The bony walls separating the ethmoidal cells from the brain above and from the orbit externally are very thin: the orbital plate may even be deficient in places, the openings being closed by membrane. Onodi¹

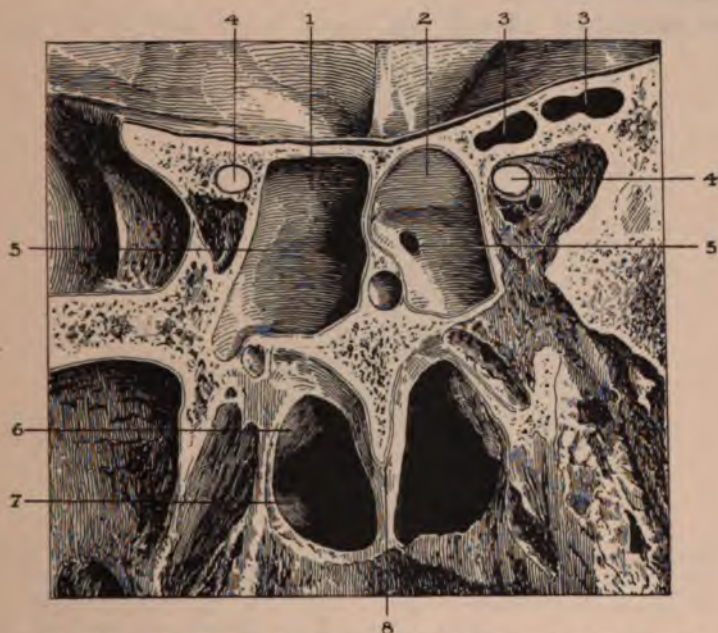


FIG. 16.—SECTION THROUGH THE POSTERIOR PART OF THE NOSE SHOWING THE RELATIONS BETWEEN THE POSTERIOR ETHMOIDAL AND SPHENOIDAL SINUSES AND THE OPTIC NERVES, VIEWED FROM BEHIND (after Onodi). 1, Left sphenoidal sinus; 2, right sphenoidal sinus; 3, posterior ethmoidal cells; 4, optic nerves; 5, openings of the sphenoidal sinuses; 6, posterior end of middle turbinate; 7, posterior end of inferior turbinate; 8, posterior end of nasal septum.

found these apertures present 18 times in 4,000 skulls. The posterior ethmoidal cells often come into close relationship with the optic nerve (see Fig. 16).

It will be seen also that the ethmoidal cells are closely related to the other accessory cavities of the nose, the sphenoidal, frontal and maxillary sinuses. They are separated from these cavities by thin bony septa, which are easily destroyed as the result of suppuration; thus another sinus—for instance the maxillary sinus—may become infected from primary ethmoidal disease, or the frontal sinus may communicate with and infect the ethmoidal cells.

¹ Onodi, *Archiv für Laryngol.*, 1903, xv. p. 62.

The **ostia** of the ethmoidal cells may be small and round or large and cleft-like: two cells may open by a common ostium. The cells which open into the infundibulum or hiatus semilunaris generally have their ostia at the lowest part of the cavity. Other cells, for instance those situated in the bulla ethmoidalis and in the anterior end of the middle turbinate, open near their roofs into the middle meatus just below the attached margin of the middle turbinate.

The ethmoidal cells are practically absent at birth, and are developed during infancy and childhood by protrusions from the nasal cavity into the cartilaginous ethmoid.

The **sphenoidal sinuses** are situated in the body of the sphenoid



FIG. 17.—HORIZONTAL SECTION THROUGH UPPER PART OF NOSE, VIEWED FROM ABOVE. *a*, Sphenoidal sinus (the extreme asymmetry of these cavities is well shown); *b*, posterior ethmoidal cells; *c*, middle ethmoidal cells; *d*, floor of the orbit; *e*, upper part of the middle meatus; *f*, upper aperture of the lachrymal duct; *g*, septum.

bone and are generally quadrilateral in shape. The **anterior wall** looking downwards and forwards, is usually the thinnest, being $\frac{1}{2}$ to 1 millimetre in thickness. This is the most important wall from a surgical standpoint, as through it the sinus must be opened in disease. This wall may be divided into three portions, a nasal, an ethmoidal, and a maxillary, as is well shown in a transverse section such as Fig. 18. Onodi¹ examined 28 skulls: in 14 the nasal part of the wall was the largest in extent, in 10 the ethmoidal part, and in 4 they were equal. In six skulls only, out of the 28, did the sphenoidal sinus come into relationship

¹ *Archiv für Laryngol.*, 1904, xvi. p. 454.

with the maxillary antrum; in one of the series, it came into relationship with the frontal sinus. The **upper wall** divides the sinus from the cranial cavity, and is usually composed of dense bone 2-4 mm. thick, but it may be thin or even defective (Zuckerlandl). The other walls are thick, and are of no surgical importance. Turner gives the average dimensions of the sphenoidal sinuses as 18 mm. in all three diameters, but they are extremely variable, and are rarely symmetrical. One sinus may be very large, while the other forms a mere slit (see Fig. 17), or one sinus, or even both, may be absent. Kicer¹ found both sinuses absent

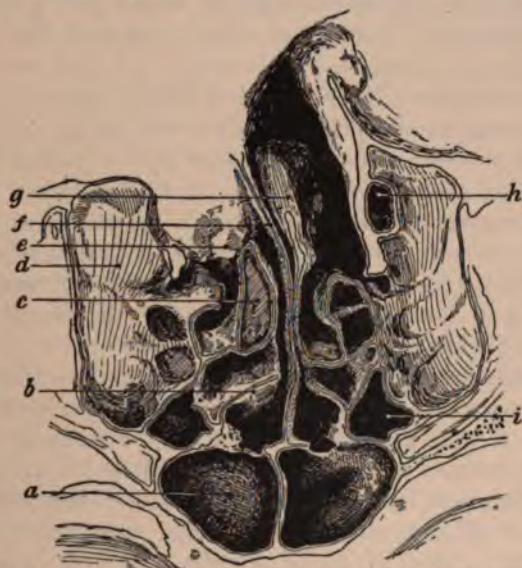


FIG. 18.—HORIZONTAL SECTION THROUGH UPPER PART OF NOSE, VIEWED FROM BELOW. *a*. Sphenoidal sinus (the cavities in this specimen are unusually symmetrical); *b*. superior turbinate; *c*. bony cyst in anterior end of middle turbinate; *d*. roof of antrum; *e*. nasal polypus; *f*. septum; *g*. anterior end of middle turbinate; *h*. lachrymal duct; *i*. posterior ethmoidal cell.

7 times in 195 skulls. It is important to remember that the larger the sinus the thinner its walls will probably be.

The **ostium** of the sphenoidal sinus is situated in its anterior wall near the upper part, close to the nasal septum, and leads directly into the fourth or highest meatus. It is round or oval, and varies from 1-4 mm. in diameter. From its situation it follows that the opening is normally invisible by anterior rhinoscopy, but it may generally be brought into view by the removal of the posterior half or more of the middle turbinate. It may also be visible when atrophy of the middle turbinate is associated with an unduly roomy nose, as in some cases of atrophic rhinitis. The opening is 7-8 cm. distant from the anterior nares; 8.3 cm. in men, 7.6 cm. in women, according to Grünwald. When an attempt is made to

¹ *Laryngoscope*, 1899, vi. p. 83.

catheterize the sinus the probe, with its point bent slightly outwards and downwards, should be passed across the middle of the inferior border of the middle turbinate. It is pushed gently backwards, upwards and slightly outwards, until the anterior surface of the sphenoid is reached, when, with a little manipulation, the probe may be felt to slip through an opening and to pass onwards for another 1-2 cm.

Development. The sphenoidal sinus is usually apparent about the third to fourth year (Symington), and gradually increasing in size, attains its full relative development about the sixth or seventh year. It is developed within the sphenoidal turbinate, which forms the anterior or nasal wall of the sinus. Coffin states that a distinct cavity may be seen in the first year.

The cranial **relations** of this sinus are very important. On the upper surface of the superior wall in the middle line lie the optic commissure and the pituitary body: and on each side of the middle line, separated from the sinus by a very thin bony septum, lie the internal carotid artery and the optic nerve. On its outer side the sphenoidal sinus comes into close relationship with the cavernous sinus and the numerous nerves contained in it. This is the usual arrangement, but frequently the optic nerve is separated from the sphenoidal sinus by one of the posterior ethmoidal cells (Onodi).

The great **extent** of the accessory sinuses of the nose may be gathered from the fact that the average total capacity of the accessory sinuses on one side only is 44.6 c.cm., which is about 10 c.cm. greater than that of both nasal cavities proper (Braune and Clasen). I have confirmed these measurements in two skulls by the rather laborious method of making casts of all the various cavities and then measuring the casts. The heads were soaked in melted paraffin wax and aspirated until all the air had been removed and every cell and cavity was filled with paraffin. The preparation was then allowed to cool and the bones and soft parts dissolved off with strong hydrochloric acid.

The **blood supply** of the nose is derived chiefly from the sphenopalatine branch of the internal maxillary artery. The posterior nasal branches of this artery supply the greater part of the outer wall of the nose, including the inferior and middle turbinates. The naso-palatine branch supplies the posterior two-thirds of the nasal septum. These vessels send branches to the mucous membrane lining the sphenoidal, ethmoidal and frontal sinuses. The anterior ethmoidal branch of the ophthalmic artery supplies a small area of the anterior part of the outer wall of the nose and of the septum: the posterior ethmoidal branch of the same artery supplies some of the ethmoidal cells. A few other arterial twigs enter the nose anteriorly and posteriorly.

The veins leave the nose with the corresponding arteries. The ethmoidal veins join with the ophthalmic vein and communicate with the veins of the dura mater and of the olfactory bulb, and sometimes with

the longitudinal sinus by the vein in the foramen caecum (often obliterated). The sphenopalatine vein empties into the pterygoid plexus. Small veins also pass out at the anterior margin of the nose to join the plexus on the upper lip, and other small twigs pierce the bony framework of the nose and join the commencement of the facial vein.

The **lymphatic vessels** of the nose are numerous and form a large network over the mucous membrane. The majority of the vessels pass backwards, and unite with those of the throat and palate, and then enter the deep cervical glands which lie behind and below the angle of the jaw. The lymphatics of the ethmoidal region form connections with the subdural and subarachnoid spaces of the brain through the lymphatic spaces which surround the branches of the olfactory nerve. These communications, which can readily be demonstrated by injection, are extremely interesting, and may explain the cerebral symptoms—headache, inability to fix the attention, mental dulness, depression, neurasthenia—which are so commonly associated with ethmoidal disease, nasal polypi, etc. They may also serve as channels of infection in suppurative affections of the nose and ethmoidal cavities.

The **nerve supply** like the vascular is derived from two origins. The anterior portion of the nose, both the outer wall and the septum as far back as the naso-palatine canal, that is the part corresponding to the original embryonic fronto-nasal process, is supplied by the nasal branch of the first division of the fifth nerve. The posterior region of the nose, an outgrowth from the middle part of the skull united with the upper jaw, is supplied chiefly by the second division of the fifth nerve through the sphenopalatine ganglion. This ganglion gives off two small upper nasal branches which enter the back part of the nasal fossae and supply the upper and posterior part of the septum, the corresponding parts of the superior and middle turbinate bones and some of the posterior ethmoidal cells. The largest branch, the naso-palatine nerve, crosses the roof of the nose and runs downwards and forwards along the septum. It gives off branches which supply the greater part of the outer wall of the nose including the middle and inferior turbinates and the greater part of the septum. The frontal sinus is supplied by the nasal nerve and the antrum by branches of the superior maxillary nerve.

HISTOLOGY.

Physiologically the nasal fossae may be divided into three parts, characterised by differences in function and in the structure of the lining membrane; these are the vestibule, the respiratory and the olfactory regions.

The **vestibule**, or part immediately within the anterior nares, is formed by a protrusion inwards of the skin of the face. The anterior part of the vestibule is studded with short stout hairs, or vibrissae, and contains

large sebaceous and sweat glands. It is lined by stratified squamous epithelium. Behind this is a transition area: the skin gradually loses its characteristics, hair-follicles, glands, etc., disappear, and the epithelium becomes first round or cubical, then conical or columnar with large nuclei, and ultimately ciliated. The dividing line between the mucous



FIG. 19.—SEMI-DIAGRAMMATIC SECTION THROUGH THE MUCOUS MEMBRANE OVER THE INFERIOR TURBINATE SHOWING THE VASCULAR SINUSES DISTENDED. (After Zuckerkindl.)

membrane and the skin is thus not sharp, and marked individual differences are met with.

The **respiratory region** of the nose lies immediately behind the vestibule, and comprises by far the largest part of the nasal cavity. It is lined throughout by a thick vascular mucous membrane covered by columnar ciliated epithelium.

The **mucous membrane** over the greater part of the nose is 1 mm. or more in thickness. In certain places it much exceeds this, thus, over the inferior turbinate and inferior meatus it is 2-3 mm., and over the lower edges of the middle and inferior turbinates about 7 mm. thick. There is

also a local thickening on the septum opposite the anterior end of the middle turbinate, known as the tubercle of the septum. This eminence is due chiefly to a collection of glands, but a few venous sinuses are also present. On the posterior end of the inferior turbinate the membrane is often divided into folds by more or less deep longitudinal sulci. Also on the posterior part of the septum thick parallel folds of mucous membrane may often be seen. These are most marked in the foetus, but are



FIG. 26.—SECTION OF THE MUCOUS MEMBRANE OVER THE INFERIOR TURBINATE. (After Zuckerkandl.) E. Ciliated epithelium; b. basement membrane; S. lymphoid tissue; v. vascular sinuses.

present in 30 per cent. of adults, and may be greatly hypertrophied in disease. These folds consist to a large extent of lymphoid tissue, which is often collected into nodules. In the lower part of the nose the normal colour of the membrane is reddish; in the upper and posterior part it is brown or grey.

The **epithelium** covering the inferior turbinate consists of several layers, the most superficial of which is formed by columnar ciliated cells; between these cells appear a few mucus-secreting beaker cells. Beneath the epithelium is a thick basement membrane continuous with the under-

lying connective tissue. It contains small vessels for the nourishment of the epithelium, and is pierced by minute canaliculi. Beneath this again is a layer of adenoid tissue, often well, often slightly marked. This tissue is greatly increased in catarrhal affections, but is probably a normal structure. The round cells are chiefly seen around the glands, but may be collected into lymphoid follicles. Below the adenoid layer are large masses of glands and venous spaces forming the bulk of the mucous membrane. The glands are racemose and mucus-secreting, and are most numerous in the posterior part of the nasal fossa. Around and below the glands are numerous large vascular spaces, forming a cavernous plexus. These venous sinuses have thick walls containing much muscular tissue. They receive their blood supply in a somewhat peculiar manner. The arterioles of the mucous membrane run up vertically towards the surface and branch extensively in the above-mentioned adenoid layer. From this the blood is again collected into small veins, which open into the large cavernous spaces. Thus the blood does not pass directly from the arteries into the sinuses, but goes through a previous capillary circulation.

The mucous membrane is traversed by numerous bundles of elastic fibres, which come off from the superficial layer of the periosteum, and end in the adenoid layer of the mucous membrane. Subdividing and reuniting they form an elastic network between the glands and the cavernous sinuses. Bundles of plain muscular fibres are also found around the veins and the acini of the glands, as well as running independently through the mucous membrane. These structures have led some authors to describe the nasal mucous membrane as being "largely composed of erectile tissue," but the designation is hardly accurate. The abundance and size of the venous sinuses and the large amount of muscular and elastic fibres in the mucous membrane allow of rapid and great variations in its thickness in response to the varying needs of the respiratory function.

The mucous membrane over the greater part of the ethmoidal region of the nose is intimately blended with the periosteum, while in the inferior meatus it is separated from it by the thick vascular and glandular layer above described. The mucous membrane around the ostia of the cavities in the infundibular region is very loosely attached, and tends to form folds which easily and rapidly become oedematous.

The **olfactory region** is very small: it is limited to the median side of the superior turbinate and the corresponding area of the septum, but is somewhat irregular. The mucous membrane is brownish grey, and covered by columnar non-ciliated epithelium. It contains little connective tissue, but many lymphoid cells, some of which are pigmented. It also contains many serous glands which are less branched than those in the lower region of the nose; the acini are lined, or almost filled, with small columnar cubical cells. These are the tubular glands of Bowman.

The **accessory sinuses** are lined by a thin, pale mucous membrane covered throughout with ciliated columnar epithelium. The epithelial layer is usually two or three cells in thickness, and beneath it is a loose areolar tissue containing a few small racemose glands and blood-vessels. The deeper part of this layer is dense in structure and continuous with the periosteum covering the bone. This is my own experience and I believe that of most other observers. Wingrave, however, states that the mucous membrane is covered by a single layer of columnar epithelium which is ciliated only near the ostia of the sinuses: also that in the antrum the glands are found only on the inner wall.

FUNCTIONS OF THE NOSE.

The **path of the air stream** through the nose has been studied by Paulsen, Zwaardemaker, Scheff and Kayser, Franke and Schäffer, on models and on the dead body, and by Parker and others on the living. The results of these experiments practically agree, and show that the air in

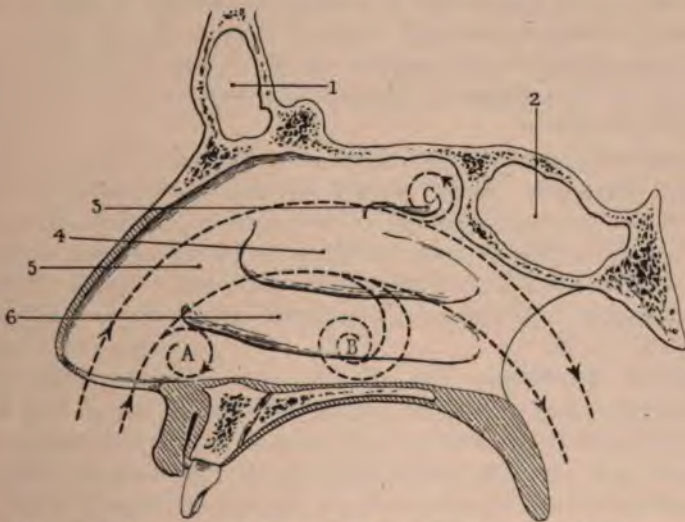


FIG. 21.—A DIAGRAMMATIC FIGURE SHOWING THE PATH OF THE AIR STREAM THROUGH THE NOSE. 1, Frontal sinus; 2, sphenoidal sinus; 3, superior turbinate; 4, middle turbinate; 5, entrance to the middle meatus; 6, inferior turbinate. The path of the air stream is indicated by the dotted lines. A, B, C represent three whorls or eddies.

inspiration does not take a straight course along the inferior meatus, but ascends in a curved direction from the anterior nares through the vestibule and atrium meatus medii into the middle and superior meatus, and then gradually descends towards the choanae. Parker in a series of cases noted the result of breathing air impregnated with the fine white dust of *lycopodium*. A broad band of deposited dust was seen along the septum and the outer wall of the nose ascending towards the anterior end of the

middle turbinate and passing along its free edge and the corresponding part of the septum. By posterior rhinoscopy the posterior and upper border of the middle and superior turbinates and the roof of the post-nasal space were seen covered with dust. The path of the expired air was observed by making the patient, while under observation, exhale ordinary tobacco smoke through the nose. The smoke was seen to pass along the inferior meatus, and in a less degree along the lower part of the middle meatus. This last observation differs from the results obtained by experiments on the dead body, in which the path of the expired air was shown to be similar to that of the inspiration, but to extend less high into the nose. Parker's experiment is probably correct, for if a small piece of wool be placed in the middle meatus, there is great difficulty in expelling it by blowing the nose, but it can quite easily be blown out if placed in the inferior meatus. The same holds true of the nasal secretion which naturally tends to accumulate in the inferior meatus. The experiments on models show that in addition to the main stream of air, one or more whorls are formed, chiefly in the lower part of the nose (Fig. 21). The best model to demonstrate the air currents is obtained by splitting a skull, removing the nasal septum, and replacing it by a glass plate. The nasal passages are blackened, and tobacco smoke is passed through the nose by the aid of an ordinary air pump. The smoke shows up well against the blackened surface.

Experiments have been carried out to test the air pressure in the nose in normal respiration. Franke showed that the negative pressure of inspiration was about six millimetres, and the positive pressure of expiration about four millimetres in quiet breathing. The experiments of Goodale¹ and of Scanes Spicer² practically agree with this. Owing to the very slight variations in pressure it is advisable to use a water instead of a mercury manometer.

Olfactory Functions. The olfactory sense includes not only smell, but the greater part of what is popularly known as taste. This function is of much greater importance to the organism than is perhaps generally recognised. It not only lends much to the pleasures of life, to the appetite for, and enjoyment of, food, but acts as a sentinel placed at the very entrance of the respiratory and alimentary channels to give immediate warning of the approach of unhealthy foods and atmospheres. For the proper fulfilment of the function it is necessary that the special nerve cells and centres should be intact, that the mucous membrane of the nose should be slightly moist, and that the inspired air should have free access to the olfactory region.

The **Respiratory Functions** of the nasal mucous membrane are extremely important.

¹ *Boston Medical and Surgical Journal*, 1896, cxxxv. pp. 457 and 487.

² *Proceedings of the Laryngological Society of London*, 1902, x. pp. 7 and 30.

1. The inspired air is **warmed**, being raised approximately to the body temperature. It is obvious that the large extent and the arrangement of the venus plexuses of the mucous membrane are peculiarly adapted to the fulfilment of this function. The importance and action of these plexuses may be best studied clinically. On examining the normal nose the inferior turbinate appears large, round and plump, but if a little cocaine or other astringent be applied, it soon presents a sharp thin edge, and the mucous membrane becomes pale and wrinkled. In health the turbinated bodies vary in size according to the atmospheric conditions. Thus they swell when cold air is breathed so as to provide a larger blood supply to warm it, and they diminish in size when warmer air is inspired.

2. The air is **saturated** with **moisture**. The fluid is probably secreted by the glands of the nose and, to a less extent, by those of the accessory cavities and by the superficial beaker cells in the mucous membrane. It may also be partly due to exudation through the small canaliculi in the basement membrane.

These two functions, for which the convoluted surfaces render the nose specially adapted, save the other respiratory organs a great amount of work. When the functions of the nose are in abeyance there is a great tendency to a dry condition of the pharynx, larynx, and trachea, and a liability to catarrh of these regions, and probably also to pulmonary diseases.

3. The air is **purified** from dust and micro-organisms. This function has been studied by Heymann, Kayser, Bloch, Aschenbrand, StClair Thomson, Hewlett, and others. Most observers agree that the interior of the nose and the mucus covering the nasal mucous membrane proper are usually sterile. Thus Thomson and Hewlett found the nasal mucosa sterile in 80 per cent. of their examinations, and only a few organisms were obtained in the remainder.

What becomes of the organisms in the inspired air still remains doubtful. It is probable that some of them are arrested by the vibrissae, upon which numerous bacteria are always found, and that those which reach the interior of the nose are entangled in the thin layer of sticky mucus which everywhere covers the nasal mucous membrane, and, thus held, are swept away by the movements of the cilia of the epithelium. It is possible that the nasal mucus, or the serous exudation which exudes from the canaliculi of the basement membrane, possesses a certain amount of bactericidal action as Lermoyez suggested.¹ At any rate, when living cultures of non-pathogenic organisms are introduced into the nose, they are found to disappear rapidly.

The importance of the ciliated epithelium to the well-being of the nose and to the general health can hardly be over-estimated. The action of a single cilium is extremely slight, but the aggregate effect of the myriads

¹ See also Piaget, *Annales des Mal. de l'Oreille, etc.*, 1897, xxiii. p. 117. This observer finds nasal mucus bactericidal to some organisms.

of cilia within the nose must be enormous. The whole of the nasal secretion with the dust, organisms, etc., which gain entrance to it, is ceaselessly swept back towards the naso-pharynx, and the secretion of the accessory cavities is also removed entirely by this agency. Ciliated epithelium is a highly specialised cell. Its functions are easily impaired by catarrh, etc., and if it is destroyed, as by severe purulent catarrhs, by extensive operations or traumatism, its place will be taken by a lower form of epithelium, either simple cubical or squamous cells. This is an important factor in the causation of that grave disorder known as atrophic rhinitis.

The large vascular sinuses which form a peculiar feature of the nasal mucous membrane, together with the bulk of the secreting glands are collected in the inferior turbinate. These structures play the chief part in cleansing, warming and moistening the inspired air. When dust or any other irritating particles gain entrance into the nose, the vascular sinuses dilate, the secretion of the glands is increased, and abundant fluid is poured out to wash the irritant away. Similar physiological responses are constantly made to meet variations in the temperature or dryness of the air. It is most important, therefore, to respect the integrity of the inferior turbinates. Parts of them may often be removed without harm resulting, but as a rule, it is worse than useless to restore nasal breathing by removing the structure upon which the value of nasal respiration mainly depends. The upper air passages will suffer less from respiration through the healthy mouth than from breathing through a nose when the inferior turbinates have been removed.

The following works may be consulted :

On Anatomy of the nose generally.

ZUCKERKANDL. Normal u. path. Anat. der Nasenhöhle u. ihrer pneumatischen Anhänge. Wien, 1893.

QUAIN'S ANATOMY. Arts. by Thane, vol. ii. part i. 1890, and Schäffer, vol. iii. part iii. 1894.

LOGAN TURNER. The Accessory Sinuses of the Nose. Edinb. 1901.

MIHALKOVICS. Heymann's Handbuch der Laryngol. u. Rhinol., Bd. iii., p. 1-86. Wien, 1899.

HAJEK. Path. u. Therap. der entzündl. Erkrank. der Nebenhöhlen der Nase. Leipzig u. Wien, 1899.

BRAUNE AND CLASEN. Zeitschrift für Anat. u. Entwicklung, 1877, ii. p. 1. GRÜNWALD. Die Lehre von den Naseneiterungen, 2te Aufl., München, 1896.

ONODI. The Anatomy of the Nasal Cavity (Trans. by StC. Thomson). London, 1895.

CRYER. The Dental Cosmos, 1903, xlv. p. 841.

COFFIN. (Development of the Sinuses) Amer. Journ. of Med. Science, 1905, cxxix. p. 297, and Journal of Laryngol., 1904, xix. p. 593.

Antrum.

DMOCHOWSKI. Archiv für Laryngol., 1895, iii. p. 255.

ZIEM. Journal of Laryngol., 1895, xi. p. 333.

Frontal Sinus.

- KICER. Laryngoscope, 1899, vi. p. 83.
 MAX SCHEIER. Archiv Internat. de Laryng., 1901, xiv. p. 321.
 ONODI. Archiv für Laryngol., 1903, xiv. p. 375.
 LOTHROP. Annals of Surgery, 1898, xxviii. pp. 601, 647; 1899, xxix. pp. 73, 175.

Ethmoidal Cells.

- ONODI. (Cells of middle turbinate) Archiv für Laryngol., 1904, xv. p. 307.
 HARMER. (Cells of middle turbinate) Archiv für Laryngol., 1902, xiii. p. 163.
 ONODI. (Relation of posterior ethmoidal cells to optic nerve) Archiv für Laryngol., 1903, xv. p. 259, and 1903, xiv. p. 360.

Sphenoidal Sinus.

- ONODI. Archiv für Laryngol., 1904, xvi. p. 454.

Embryology and Histology.

- KILLIAN. (Anat. of nose of human embryo) Archiv für Laryngol., 1894, ii. p. 234; 1895, iii. p. 17; 1896, iv. p. 1.
 WINGRAVE. (Histology of accessory sinuses) Journ. of Laryng., 1903, xviii. p. 416.
 SCHIEFFERDECKER. Heymann's Handbuch der Laryngol. u. Rhinol., Bd. iii. p. 87. Wien, 1899.

Functions of Nose.

- MACDONALD. (Warmth and moisture) Diseases of the Nose. London, 1890.
 GOODALE. Boston Med. and Surg. Journ., 1896, cxxxv. pp. 457 and 487.
 GAULE. Heymann's Handbuch der Laryngol. u. Rhinol., Bd. iii. p. 152.
 ZWAARDEMACHER. (Olfactory) Journ. of Laryngol., 1900, xv. p. 405.
 STCLAIR THOMSON and HEWLETT. (Arrest of micro-organisms) Journ. of Laryngol., 1895, ix. p. 796; Lancet, Jan. 11th, 1896, and Med. Chir. Transactions, vol. lxxviii., 1895.
 PARK and WRIGHT. Journ. of Laryngol., 1898, xiii. p. 124 (gives full references to preceding papers on subject).
 E. FRANKEL. Virchow's Archiv, 1882, xc. p. 499.
 LOEWENBERG. Deutsch. med. Wochenschr., 1885, xi. pp. 5 and 22.
 HAJEK. Berlin. klin. Wochenschr., 1888, xxv. p. 659.
 WURTZ and LERMOYEZ. Annales des Maladies de l'Oreille, etc., 1893, p. 661.
 KLEMPERER. Journ. of Laryng., 1896, x. p. 286.

Path of Air Stream.

- SCHEFF and KAYSER. Journ. of Laryngol., 1895, ix. p. 64.
 FRANKE. Archiv für Laryngol., 1894, i. p. 230.
 BURCHARDT. (Variations in, in various forms of nasal obstruction) Archiv für Laryngol., 1905, xvii. p. 123.
 PARKER. Journ. of Laryngol., 1901, xvi. p. 345.

CHAPTER II.

THE EXAMINATION OF THE NOSE.

BEFORE examining the interior of the nose the general history of the patient, and the local and remote symptoms of which he complains should be enquired into as carefully as in an ordinary medical case. The attention should then be directed to the general aspect of the patient. The configuration of the face and nose often yields valuable information; a broad nose is likely to be associated with wide nasal fossae, and a long narrow nose with nasal obstruction. The habitual mouth-breather is at once recognised by the shape of his face, and by his general aspect; by the narrowness of the vestibule of the nose, and by the presence of deep folds or creases on the alae nasi. Any prominence or depression of the bridge of the nose or bulging in the region of the accessory sinuses should be observed. The presence of excoriation or of pustules on the skin of the upper lip is evidence of an irritating nasal discharge. The development and arrangement of the teeth, and the formation of the upper jaw, should also be examined; the neck, especially behind the sterno-mastoids, should be explored for enlarged glands. The examination of the chest, of the lungs and other organs, and the investigation of the patient's general history and condition, may be deferred until the local examination has been completed. The nose must be examined both by anterior and posterior rhinoscopy, and if necessary by digital exploration. The pharynx, larynx and ears should then be examined.

Anterior Rhinoscopy. The first requisite is a good artificial light. The electric light, gas, either in the form of an argand or incandescent burner, the oxyhydrogen lime-light, and a good paraffin lamp, are the most generally employed; acetylene gas gives a most brilliant light, but a sufficiently reliable lamp for it has not yet been discovered.

The Electric Light. The electric light is the most generally convenient whenever the current can be obtained. It has the great advantage of being always ready for use; it gives rise to but little heat; the lamp can be held or fixed in any position, and there is no danger of fire even if it be dropped. A burner of about 32 candle-power with a frosted glass

should be employed. A 50 candle-power light is sometimes used, but it is preferable to use the weaker light, and to darken the examining room. The lamp may stand upon the table, or be fixed upon a movable bracket on a wall, and it should be detachable for use as a hand lamp. It should be fitted with a bull's eye to concentrate the light, and should be completely covered in. Several additional plugs should be provided so that the lamp may be available in any house in which the electric light has been installed (see Fig. 22). If this light be used, it is necessary to provide means of warming the mirrors; a small spirit lamp may be used, or a



FIG. 22.—AN ELECTRIC LAMP WITH NERNST BURNER.

sterilizer, the latter serves two purposes at once. Lately I have been trying the Nernst lamp: it gives a very bright blue-white light similar to the oxyhydrogen lime-light, which is very pleasant to work with. It is in many respects preferable to the ordinary electric light, and the Throat and Ear department of the London Hospital has been entirely fitted with it.

Gas-light. If gas be chosen, the Argand burner, or a lamp with an incandescent mantle, may be used. The latter gives a powerful but rather unpleasant and patchy, white light. The lamp should be fitted with a metal chimney with reflector and bull's eye, and this again should be enclosed in an asbestos shield, as the flame is apt to give off a great deal of heat. On this account the lamp should be kept at a little distance from the patient's head, and the patient's hat must be removed for fear of burning

it. The lamp must be fixed to an adjustable stand which can be raised or lowered at will (see Fig. 23).

The Oxyhydrogen Lime-light. This gives perhaps the best light of all, but it is troublesome, expensive, and cumbersome. The lamp can be fixed

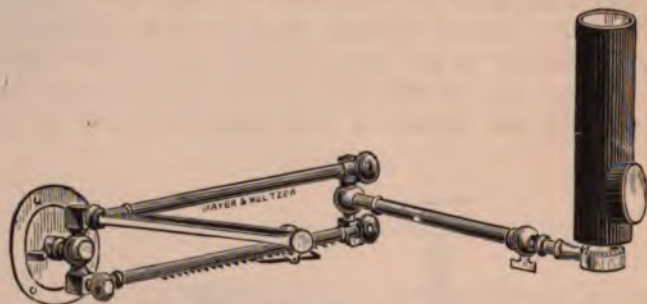


FIG. 23.—ARGAND GAS BURNER WITH MACKENZIE'S ADJUSTABLE WALL BRACKET.

on a portable tripod stand, and erected anywhere. A cylinder containing oxygen, and a supply of ordinary coal gas, are required, with the necessary lengths of tubing.

The illumination shows objects almost in their natural colours, and it is very pleasant to work with. It is suitable only when in constant use, and is not nearly so convenient as the electric light.



FIG. 24.—CRESSWELL BABER'S INCANDESCENT SPIRIT LAMP WITH OPAQUE CHIMNEY AND BULL'S EYE.

When none of these lights are available, Cresswell Baber's **incandescent spirit lamp** or an ordinary **paraffin lamp** may be used. The latter may be fitted with reflector and bull's eye; it should have a broad flat bottom, and the top of the oil should be covered by two or three layers of finely-chopped cork, to prevent its being spilt by shaking. Baber's lamp (see Fig. 24) is a great improvement on this, and I now always employ it for examinations in patients' houses.

Position of Patient, etc. The surgeon must wear an ordinary frontal mirror, such as is used for laryngoscopy; it may be attached to the head by a band or by a spectacle frame. The mirror should have a small aperture in its centre, and should always be worn over the eye on the same side as the source of the light, when it will be found to shade both eyes from the glare. In

this country the lamp is usually placed just behind and to the left of the patient's head, and consequently the mirror must be worn over the surgeon's right eye. As, however, most surgeons use the right hand in operating, there are many advantages to be obtained by

reversing this position, so that the movement of the operating hand may not interfere with the source of the light. The patient should be seated on a firm chair with a narrow seat and a vertical back, so that he is compelled to sit upright or lean slightly forward. The surgeon sits facing him, and an ordinary music stool, which can be adjusted to any height, will be found a most convenient seat.

Speculum. For anterior rhinoscopy it is necessary to use a speculum to



FIG. 25A.—LENNOX BROWNE'S NASAL SPECULUM.



FIG. 25B.—THUDICHUM'S NASAL SPECULUM.



FIG. 25C.—METHOD OF USING THUDICHUM'S SPECULUM.

dilate the anterior nares. Thudichum's or Lennox Browne's (Fig. 25) are the most convenient, as they have solid blades, which prevent the vibrissae obstructing the view. The Thudichum speculum is often painful to the patient if the spring is too strong: it should therefore either be compressed by the fingers, or the spring should be broken. It is an advantage also to bend the speculum so that the outer blade projects a little further back than the blade which lies next the septum. Fränkel's speculum (Fig. 26) is preferred by some; Morell Mackenzie strongly recommended it. It is comfortable to the patient, easy to introduce, and is self-retaining. It has

the great disadvantage that the blades are fenestrated, and consequently allow the vibrissae in the nasal vestibule to obstruct the view. Duplay's speculum is also much used. It consists of a bivalve, which is introduced closed, and opened by means of a screw attached to the side (Fig. 26). This speculum is comfortable to the patient, can be opened slowly to any desired extent, and is almost self-retaining. It is a little difficult to insert, and somewhat cumbersome. It is impossible to say which speculum is really the best; every specialist will prefer the one with which he is accustomed to work. Thudichum's and Lennox Browne's will be generally found the most convenient.

Objects seen. On introducing the speculum whilst the patient is sitting in the ordinary position, the most prominent object to be seen in the nose



FIG. 26A.—FRÄNKEL'S NASAL SPECULUM.



FIG. 26B.—DUPLAY'S NASAL SPECULUM.



FIG. 26C.—SELF-RETAINING WIRE NASAL SPECULUM.

is the globular anterior end of the inferior turbinate. It should be possible to see some distance down the inferior meatus, and between the inferior turbinate and the septum. When the turbinate is unduly large it is impossible to see into the inferior meatus at all; when it is small, or when the spongy tissue is temporarily collapsed, it may be possible to see the entire length of the inferior meatus, or even to obtain a view of the posterior wall of the naso-pharynx. By tilting the patient's head backwards, the middle meatus and the middle turbinate come into view; the superior turbinate can only be seen in exceptional circumstances. The colour and contour of the parts having been examined, a little cocaine and suprarenal extract solution should be applied; this acts as a strong astringent to the nasal mucous membrane, and enables the posterior parts of the nose to be more readily examined. Growths situated far back and other forms of obstruction hitherto concealed come readily into sight. This aid to rhino-

scopy should never be omitted, but it is especially important when the nasal passages are unduly narrow or distorted.

The Nasal Probe. Probes for use in the nose should be made of soft flexible metal, blunt pointed and mounted upon handles inclined at an angle of 60 degrees (Fig. 27). They should always be used as an adjunct to anterior rhinoscopy. The attachments of growths, their mobility



FIG. 27.—JOBSON HORNE'S NASAL PROBE.

and consistence can thus be determined. Masses partially concealed from view can often be rolled out from under the concavities of the turbinates. The probe is also useful in detecting foreign bodies, the presence of bare or necrosed bone, and the existence and extent of obstructions, adhesions, perforations of the septum, etc.

Median Rhinoscopy. By anterior rhinoscopy it is possible to see the anterior end only of the middle turbinate and a small extent of the middle meatus. Attempts have been made by Zaufal, Krämer and later by Killian,¹ to overcome this deficiency and to explore more fully the middle and superior meatus of the nose by means of a longer speculum. This method of examination has been entitled median rhinoscopy. Killian's speculum is the best: it consists of two thin tapering blades which can be introduced closed and opened when in position (Fig. 28). The middle turbinate and the septum are anaesthetised, and the closed speculum introduced into the cleft between them. The middle turbinate being attached only by a thin lamina of bone to the outer wall of the nose, may be easily bent outwards as on a hinge, by gentle continued pressure. Thus, as the speculum is slowly opened, the turbinate is deflected until the superior meatus, the roof of the nose, and the anterior surface of the sphenoid are brought into view. In a similar way the speculum can be introduced under the middle turbinate into the middle meatus of the nose, and the orifices of the various accessory sinuses which



FIG. 28.—KILLIAN'S SPECULUM FOR MEDIAN RHINOSCOPY.

¹ *Münchener Medicin. Wochenschr.*, 1896, xliii. p. 768.

open in this region can be examined. The method has a limited application, but it is certainly useful under some circumstances. It is especially valuable as an aid to the diagnosis of suppuration in the posterior ethmoidal region and in the sphenoidal sinus.

Posterior Rhinoscopy.



FIG. 29.—LACK'S TONGUE DEPRESSOR.

Posterior rhinoscopy is thus performed. A tongue depressor (the one shown in Fig. 29 will be found most convenient), is held in the left hand, and passed well back on to the centre of the tongue whilst the mouth is opened to about half its full extent. By raising the proximal end of the tongue depressor the base of the tongue is pressed downwards and forwards well away from the uvula. The patient's chin should be steadied and drawn forward by one of the fingers of the left hand. A strong light is now focussed on to the lower part of the posterior wall of the pharynx, and a small laryngeal mirror,

a quarter to half an inch in diameter and inclined about 60° to 80° to its handle, is passed to one or other side of the uvula into the posterior part of the pharynx, care being taken not to touch the uvula or tongue. By turning the mirror in various directions all the structures in the post-nasal space can be seen one by one. The posterior ends of the septum and of the three turbinates, the cushions and orifices of the Eustachian tubes, the depression behind them known as Rosenmüller's fossa and the roof of the naso-pharynx should be examined in regular order (Fig. 30). This method of examination may be extremely easy or so difficult as to be almost impossible. The chief trouble arises from the tendency of the patient to raise the soft palate so as to bring it in contact with the posterior pharyngeal wall. To prevent this his attention should be distracted by conversation, or he should be directed to breathe gently through the nose or to hold the breath. Sometimes this object

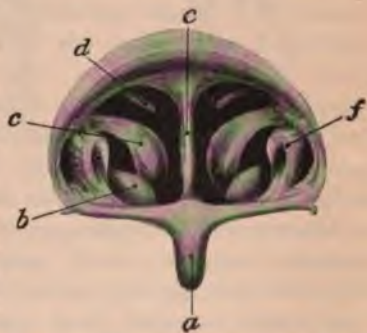


FIG. 30.—THE POST-NASAL SPACE AS SEEN BY POSTERIOR RHINOSCOPY. *a*, uvula; *b*, inferior turbinate; *c*, middle turbinate; *d*, superior turbinate; *e*, septum; *f*, Eustachian tube.

may be obtained by asking the patient to say the word "hang." By these manoeuvres a view, if only a momentary one, can usually be obtained. The mirror should never be retained in position very long at a time; it should be removed on the first sign of retching, but may be introduced repeatedly. In a few cases the examination may be facilitated by spraying or painting the parts with cocaine, but this often increases the patient's

tendency to retch. Formerly a hook to draw the palate and uvula forward was much used as an aid to posterior rhinoscopy; but it is a clumsy instrument and rarely necessary. The best form is White's, which is retained automatically in position (Fig. 31). As a rule it is necessary to apply cocaine to the palate before using it, but in spite of this it frequently



FIG. 31.—WHITE'S PALATE RETRACTOR.

excites violent reflex movements, and thus defeats the end in view. The retractor is chiefly of value when operating upon the post-nasal space, under guidance of the mirror.

Objects seen. As seen by posterior rhinoscopy, the posterior end of the septum is usually in the middle line, and presents a thin sharp edge with more or less symmetrical spindle-shaped thickenings near its centre (Fig. 30). The inferior turbinates appear small, the middle turbinates comparatively large, and above these the small superior turbinates can be seen. The Eustachian cushion can be brought into view by rotating the mirror towards the side of the space. It forms a large reddish projection with a central yellowish-white depression, which denotes the orifice of the tube. The vault of the pharynx should be smooth, and the upper part of the septum where it joins on to it seems to widen out into a triangular surface. Should adenoid growths be present they may be recognised as a reddish mass occupying the vault of the pharynx, and their amount may be more or less accurately gauged by the extent to which they conceal the upper part of the septum and posterior choanae from view.

Digital Examination. Exploration with the finger is especially useful for the examination of the post-nasal space. When a view of this region is not readily obtainable, as in the case of young children, the finger may be used to ascertain the existence of adenoids, hypertrophies of the posterior ends of the turbinates, etc. The consistence and place of attachment of post-nasal tumours, or of a nasal polypus projecting posteriorly, should also be determined by this means. The finger is thus introduced. The surgeon stands behind and on the right side of the patient, passes his left arm round the patient's head, the thumb of the same hand presses in the mucous membrane of the cheek between the patient's teeth, while the fingers steady the lower jaw. The patient is directed to breathe slowly in and out, the right forefinger is passed back over the tongue until it comes in contact with the posterior wall of the pharynx to one side of the uvula; it is then quickly slipped up into the post-nasal space until the posterior edge of the nasal septum is felt. The tip of the finger should

be passed into the choana on either side, and then the back of the finger swept over the vault and posterior wall of the pharynx. If the examination be carried out gently and rapidly, as may easily be done with practice, little pain is produced; but the finger should never be retained long in position, as it always gives rise to a choking sensation and more or less discomfort. If these precautions be adopted, and if the mouth be kept open by pressing the thumb between the patient's teeth, whilst his head is fixed, there is no risk of the surgeon being bitten. Occasionally, when a general anaesthetic has been administered, the finger may be also introduced into the anterior nares to explore the ethmoidal region, to ascertain the existence of bare or broken-down bone, etc.

Other means of examination of the nose, such as transillumination of the cheek by means of an electric lamp placed in the mouth, will be described later (see Chap. XVIII.).

Transillumination should never be omitted when there is a mucopurulent or purulent discharge from the nose, or even when the patient merely complains of such symptoms, although no abnormal secretion can be seen. Quite recently a patient has been under my care complaining only of a bad smell in the nose, with slightly excessive discharge from one nostril. In spite of this, transillumination, which was carried out as a routine practice, revealed the fact that the cheek on the *opposite* side was darkened, and perforation of this antrum gave exit to much foetid discharge. This patient had been under treatment at various hospitals for over six months, and the cause of the parosmia had remained undiscovered. Another patient complained only of a bad smell in the nose, and yet antrum suppuration was also found. Such cases illustrate in a striking manner the importance of carrying out transillumination as a routine measure.

CHAPTER III.

SOME GENERAL CONSIDERATIONS ON TREATMENT.

Methods of Cleansing the Nose. Fluids may be introduced into the nose by sniffing them up or by means of the nasal irrigator, douche, syringe, or spray. The best method for cleansing purposes in ordinary cases is to sniff the lotion up through the nose from the palm of the hand, or from a small cup or glass, letting it pass into the throat and returning it by the mouth. The special cup shown in Fig. 32 is very convenient. This is the most pleasant and satisfactory method, and, though a little difficult at first, it can be easily practised after a few trials. It should be carried out before rather than after meals, as it may cause retching or even vomiting. About two ounces of fluid should be used each time, and the washing may be repeated once, twice, or more often daily. If performed with ordinary care, no ill results can follow.

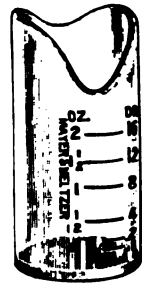


FIG. 32.—NASAL CUP.

Nasal Irrigators. If the above method is found inconvenient, the fluid may be introduced into the nose by means of a nasal irrigator (Fig. 33). This is a small, glass, bottle-shaped receptacle. It is filled with

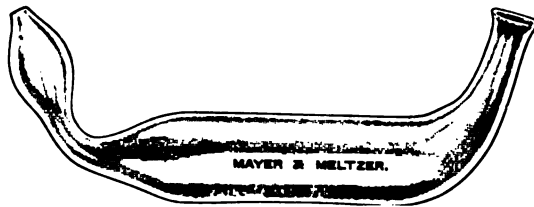


FIG. 33.—NASAL IRRIGATOR.

lotion, the finger or thumb applied to the opening at the end, and the nozzle inserted into the nostril; when the finger is removed the fluid flows gently into the nose. The lotion should then be drawn backwards into the throat and returned through the mouth. This method is easier than the previous one, and equally free from danger.

Syringing. When it is necessary to inject fluids into the nose with some force, as when crusts have to be detached, the above methods are ineffective and syringing should be employed. A small rubber ball syringe with a blunt nozzle is the most convenient form (Fig. 34). The patient should stand with the head bent well forward over a receiver, and open and breathe through his mouth. The fluid should be injected along the inferior meatus, never toward the roof of the nose. It will pass into the post-nasal space and will come out through the mouth or down the other nostril. The fluid must be injected with care and in small quantities at a time, or it may be forced through the Eustachian tubes into the ears and set up acute otitis media. This is especially liable to occur if one nostril be narrowed and the fluid is injected down the wider one. In using the syringe there is always some danger that



FIG. 34.—NASAL SYRINGE FOR PATIENT'S USE.

fluids may be forced down the Eustachian tubes, but when it is necessary to employ force to cleanse the nose—*e.g.* when tenacious crusts are present—it is the best available method.

Nasal Douche. This apparatus is well known and frequently employed. Its use is, however, dangerous because of the continuous pressure with which fluid is injected. It is extremely liable to cause acute otitis, and as it has no advantage over the syringe its use should be entirely abandoned.

Sprays. Nasal lotions may be applied by spraying, but this is never such an effective method of cleansing the nose as those above mentioned,



FIG. 35.—GOTTSTEIN'S WOOL INTRODUCER.



FIG. 36.—WOOL CARRIER.

and gives rise to more discomfort. The spray may, however, be used for the application of medicaments, such as cocaine. For the latter purpose an instrument giving a very fine spray is required: when used for cleansing purposes the coarser the spray the better.

For Children. In children who cannot be taught the method of "sniffing", fluids may be introduced into the nose with the nasal irrigator or with a teaspoon, but in most cases it is better to employ syringing, injecting the fluids with the greatest gentleness. In children even more than in adults the use of force is to be strongly deprecated.

Wool Mops. Small pledgets of wool applied with forceps or with

special wool carriers (Fig. 36) are extremely useful as an additional method of cleansing the nose. They are employed especially for detaching crusts, for which purpose they may with advantage be soaked in hydrogen peroxide solution. These mops are also necessary for cleansing the nose in cases of sinus suppuration and for removing blood during various operations.

Packing the Nose. This is a most useful aid in cleansing the nose when there is unusual dryness of the mucous membrane, or when adherent crusts are present. The method was first advocated by Gottstein, who introduced a large roll of wool into the inferior meatus with a special screw introducer (Fig. 35). Gottstein's object was to irritate the mucous membrane and excite increased secretion. The method was painful, and it was difficult to get patients to carry it out. It is quite sufficient to pack the nose lightly either with wool, or, better still, with strips of gauze. If the air be excluded the nasal secretion will remain fluid as the formation of crusts is invariably the result of evaporation, and on removing the packing the nose may appear quite clean, or, if any fluid secretion be present, it may be easily cleansed by syringing. The value of this method will be again referred to when speaking of the treatment of ozaena (see Chap. X.).

Nasal Lotions. Nasal lotions should be of about the same density as blood serum and should be used at, or just below, the body temperature. When simple cleansing is required and a large quantity of fluid is necessary ordinary salt solution (one drachm of sodium chloride to a pint of warm water) may be used. To this a few drops of sanitas or of liquid permanganate of potash may be added. All nasal lotions are improved by the addition of carbonate or sulphate of soda, as these salts dissolve or mix with the nasal mucus and make the lotions more effective (Wyatt Wingrave). One of the best lotions is Dobell's, or some modification of it. A useful formula is:

Sodii Bicarb.
Sodii Biborat. āā. gr. xv.
Acid. Carbolic. gr. iv.
Sacch. Alb. gr. xx.
or Glycerin. m xxx.
Aq. ad. oz. i.

Add one tablespoonful to two ounces of warm water for use. Dobell's original solution was nearly twice this strength.

This lotion is capable of various modifications. Thus the carbolic may be omitted when it seems too irritating; chloride of sodium may be added as a mild, or chloride of ammonium as a stronger stimulant; chlorate or iodide of potassium may be used in cases of unusual dryness of the mucous membrane. Astringents such as antipyrin, hazelin or the extract of hamamelis may also be added, but always in small doses as the nose is very intolerant of irritants. For other formulae see Appendix.

The Use of Oils. Oily solutions may be applied to the nose with a suitable spray such as an atomizer, with a small camel's hair brush, or with the wool mops above described. The latter methods are preferable when it is desired to make the application to the anterior part of the nose only; if a more general application be required it is better to use an atomizer. The best basis for oily preparations consists of equal parts of almond (or olive) oil and paroleine (or fluid vaseline). To this basis may be added various medicaments such as eucalyptus oil (one part to 20 or 30), unguentum hydrargyri nitratis (one part in 10), morphinae sulphatis (2 to 4 grains to the ounce), menthol (5 to 15 grains to the ounce) etc., as circumstances require. As the result of experiments made for me it was found that an ointment such as the ung. hydrarg. nitrat. formed a more stable mixture with this basis than with either almond oil or fluid vaseline used separately. This mixture should be used as the basis of most ointments for nasal use, as it is a great advantage to make them sufficiently fluid to be applied as above directed. In special circumstances simple lanolin may be used with advantage.

Steam Inhalations. Hot medicated steam inhalations are rarely employed in nasal diseases, but are useful in some acute conditions. The water should be of a temperature of about 140° F. and the steam should be inhaled through the nose for 5 to 6 minutes two or three times a day. The patient should remain in one room at an equable temperature while this treatment is being carried out; otherwise he runs a risk of catching cold. One of the best inhalations in nasal diseases is menthol which may be prepared by adding one teaspoonful of a five to ten per cent. solution of menthol in rectified spirit to a pint of hot water (130° F.). Tincture of benzoin (one drachm to a pint) may also be used. For other formulae see Appendix.

NASAL OPERATIONS.

A large number of operations upon the nose come under the heading of minor surgery, and can be performed under local anaesthesia. There has perhaps been a tendency in late years to operate somewhat too freely; in many conditions relief may be obtained more quickly by operative than by other methods of local treatment, and it is to be feared also that many trivial abnormalities which produced no definite symptoms have been operated upon by enthusiasts. Therefore it is well to bear in mind that there are certain risks attached even to slight operations.

The **chief dangers** attending nasal operations are, shock, haemorrhage, sepsis, and the toxic effects of cocaine or other anaesthetics. Of late results the most important is permanent injury to the mucous membrane with more or less impairment of the nasal functions.

All nasal operations are apt to be accompanied by a certain amount of **shock**, which may prove dangerous in the old and infirm. Occasionally

even slight operations in the upper part of the nose seem to be attended with considerable shock.

Nasal operations are often followed by serious loss of blood. For this reason they are dangerous in the young and in the aged; and should never be performed, when from any local or general cause there is special reason to fear haemorrhage. Thus operations on the nose should be avoided during pregnancy, during the menstrual periods, and when the patient suffers from any of the general haemorrhagic conditions such as haemophilia, purpura, etc.

Sepsis after nasal operations cannot be altogether avoided. It may show itself as a purulent rhinitis which may spread into one of the accessory cavities and produce sinus suppuration, or spread back through the post-nasal space into the Eustachian tubes and set up acute otitis media. A septic follicular tonsillitis is also frequently seen. The more severe nasal operations, especially those performed under general anaesthesia, may be followed by septic pneumonia or bronchitis. Even slight operations in the upper part of the nose, such as the application of the galvano-cautery to the middle turbinate, or the simple removal of a nasal polypus with a snare, have been followed by septic venous thrombosis, and fatal meningitis. One observer, Rethi, has recorded four deaths, two following the application of the cautery, and two following the removal of polypi.

The dangers arising from **cocaine** will shortly be pointed out. This drug must be used with especial care in the very old and in the young; besides which, it must be remembered that some patients are peculiarly susceptible to cocaine poisoning.

In children the nasal passages are very narrow, operations are difficult to carry out, and are liable to be followed by **synechiae**. It is probable also that they may interfere with the proper development of the parts.

Another untoward but fortunately very rare result of nasal operations is **optic atrophy** and blindness. Packard records a case of total amaurosis lasting 30 minutes after removal of the anterior end of the middle turbinate. Ziem, Lermoyez, and Rethi record similar cases, as well as more severe ones, in which permanent optic atrophy followed. Other cases are related by Killian, and one has been privately communicated to me. In most of these the operation was attended by excessive haemorrhage, and the optic atrophy was probably due to thrombosis of the ophthalmic vein. Still, considering the close relationship of the posterior ethmoidal region and the sphenoidal sinuses to the optic nerves, their occasional involvement in septic inflammations starting in this region would not seem improbable.

Lastly, it must be borne in mind that the nasal mucous membrane has an important respiratory function, and that the destruction or removal of too much of it may be followed by disastrous consequences to the upper air passages, and to the general health. This applies chiefly to operations upon the inferior turbinate, the whole of which body should rarely if ever

be removed. When a large piece of nasal mucous membrane has been destroyed, the injured area for months after may continue to be covered with dry mucous crusts, which give rise to considerable local inconvenience. If extensive injury has been done, the pharynx and larynx are also apt to become dry and crusty, or a condition resembling atrophic rhinitis may be produced.

Local Anaesthesia. A large number of minor intranasal operations can be performed under local anaesthesia. The best drug for this purpose is the hydrochlorate of **cocaine**, of which a 5, 10, or even 20 per cent. solution may be used. It is best to prepare the solution freshly each time it is required, by dissolving the crystals in sterilised distilled water. The drug in weak solution is apt to undergo decomposition, but a strong solution, to which is added some preservative (such as salicylic acid or resorcin¹ of either one grain to the ounce), may be kept a considerable time. With careful use the exact strength of the solution really matters little, for just enough cocaine should be applied to the site of operation to produce complete anaesthesia of the parts. Therefore the stronger the solution, the less of it required. The usual plan of spraying cocaine solution into the nose I have for some time abandoned. The instruments are continually getting out of order; they are dirty, and with the slightest variation in their lumen they give such a different spray that it is difficult to know how much of the drug is being used. If the amount injected with a single compression of the ball of the spray is measured it will often be found surprisingly large. This renders the method unsafe, especially in inexperienced hands. The best plan is to apply the cocaine on small pledgets of wool. In this way the action of the drug is limited to the part required, very little cocaine is used, and there is proportionately less danger of toxic effects. The part to be operated upon is first gently brushed over, and then pledgets of wool soaked in the solution are placed in contact with it for 5-10 minutes. Great care should be taken to prevent any cocaine running down into the throat and being swallowed; therefore, immediately after placing the wool in position, the patient's head should be bent well forward. Anaesthesia is usually complete in ten minutes, and will last five to ten minutes longer. Besides its anaesthetic effect, cocaine produces shrinking of the nasal mucous membrane by emptying the venous sinuses, and thus greatly facilitates intranasal operations by diminishing haemorrhage, and increasing the roominess of the nasal fossae. In children, cocaine must be employed with great care in a 4 or 5 per cent. solution. Since I have adopted the above method exclusively, I have never seen any serious ill effects from cocaine, either in private or hospital practice. It is said that some patients exhibit a remarkable idiosyncrasy with regard to this drug, a minute dose producing dangerous symptoms. Great caution should therefore be exercised when using it for the first time on a patient, and diffusible stimulants, such as sal volatile or whisky should always be at hand in case of faintness.

¹ Hall, *Brit. Med. Jour.*, 1896, i. p. 335.

It is well to give very nervous or weakly people a small quantity of stimulant as a prophylactic. The first effects of cocaine are stimulating, but after a brief period the patient may become pale, excitable, loquacious, and exhibit some loss of self-control. This is followed in the more severe cases by trembling, nervous depression, and physical collapse or prostration. In neurotic people an attack of hysteria is not uncommon. These symptoms should be met by placing the patient in the recumbent position and administering hot stimulating drinks, such as coffee or alcohol. It is better, however, to prevent them by using cocaine in small doses until the susceptibility of the patient to the drug is known, and by employing it in the careful way above described. The combination of cocaine with suprarenal extract by necessitating the use of less cocaine is also useful in this respect.

Eucaïne. Eucaïne, a laboratory prepared homologue of cocaine, has been strongly recommended as a substitute for the latter, as it is said to have no toxic effects. Its action in other ways is similar, but it apparently takes a little longer to produce complete anaesthesia, it does not produce such marked shrinking of the mucous membrane, and its anaesthetic effect is a little more lasting. It dissolves in water in a 10 per cent. solution, which may be sterilised by boiling without impairing its action.

The Suprarenal Gland Extract. This drug produces marked constriction of the vessels of the nasal mucous membrane, and renders it white and anaemic. Used in conjunction with cocaine, it produces more complete and longer anaesthesia, and prevents haemorrhage during small operations, making it possible to see accurately what is being done. The combination with cocaine is especially valuable in patients who are intolerant of the latter drug, as complete anaesthesia can be obtained with very little cocaine, which, moreover, is less liable to be absorbed, owing to the constriction of the vessels. Suprarenal extract alone is useless as an anaesthetic. The advantages of this drug are so obvious that for local anaesthesia in the nose I invariably use a mixture of cocaine and suprarenal extract, which I prepare in the way originally suggested by E. A. Peters.¹ A test-tube is filled for about one inch with commercial desiccated suprarenal glands, treble the quantity of distilled water is added, and the tube, closed with a wool plug, is placed in boiling water for ten minutes. The solution is filtered and an equal quantity of a 20 per cent. solution of cocaine is added to it. In this way a powerful anaesthetic and astringent solution is obtained. The exact strength of this preparation may vary somewhat, but this is a matter of little importance, as no more should be applied than is necessary to produce the full effect of the drugs. Lederman² advises the extraction of the dried suprarenal glands with glycerine. He adds one part of dried gland to six parts of a 25 per cent. glycerine solution for 48 hours. Peters' method of preparation has been employed by me for more than four years, and gives as good a result as any of

¹ Peters, *Brit. Med. Jour.*, 1899, ii. p. 851.

² *Laryngoscope*, 1899, vi. p. 217.

the drugs which have hitherto been placed on the market. I have experimented with most of these, and can recommend both Hemisine and Adrenalin. The former is very convenient, being sold in small soloids. Adrenalin is sold in solution, and may be mixed with cocaine solution, or applied separately after the parts have been anaesthetized.

The objection to the use of suprarenal extracts is that the constriction of the vessels is followed in 3-5 hours by extreme dilatation. Thus when the drug has been used as an aid to diagnosis, the patient may subsequently experience marked nasal obstruction, accompanied by profuse rhinorrhoea and sneezing. After operations, there is an increased tendency to haemorrhage, and consequently it is advisable to keep the patient within reach of the surgeon for at least 24 hours, or, if this be impracticable, to pack the nose immediately the operation is finished.

General Anaesthesia. If general anaesthesia be preferred, the choice of agent must generally be left to the anaesthetist. For short operations, nitrous oxide, alone or combined with oxygen, is probably the safest and best. When a longer anaesthesia is necessary, chloroform, ether, or some mixture of these, such as the A.C.E. mixture, can be used. The objection that ether increases the bleeding, is probably more theoretical than real; and even if there be a little more haemorrhage, the patient's breathing is more vigorous, and the reflexes are more easily maintained. Whatever agent be chosen, the safety of the patient lies in not pushing the anaesthesia too deeply. The air passages are often unavoidably filled with blood, and it is necessary that the cough and swallowing reflexes should not be abolished. If this precaution be adopted, any anaesthetic may be given with safety. When nasal obstruction is present, before inducing anaesthesia it is necessary to insert a gag, or to place a small prop between the teeth to maintain a free passage through the mouth. When there is free bleeding, it is better to turn the patient over on to his side or face; this is preferable to the position with the head hanging over the end of the table. Sponges mounted on long handles must be at hand to remove blood from the pharynx. If, in spite of this, blood enters the larynx or trachea and causes obstruction, the patient should be at once inverted and the finger passed into the larynx to try and dislodge the clot. Of course tracheotomy instruments must always be kept ready.

Nasal Antisepsis. As already stated, the nasal mucous membrane proper is usually free from micro-organisms, and therefore it is worse than useless to apply irritating antiseptics before operating upon the healthy nose. Of course all the usual surgical precautions must be taken to avoid introducing infection from without. The instruments, the operator's hands, and any material used, must be sterilised as carefully as in operations upon other regions. The hygiene of the patient's surroundings must also be attended to. This is of especial importance, as it is generally impossible to apply dressings, and consequently the inspired air and all it contains passes directly over the wound. For this reason it is a great advantage to

operate in a good surgical home, unless the patient's home conditions are exceptionally favourable.

When pus or other discharges are present in the nose, true asepsis or antisepsis is out of the question. The surgeon must be content to cleanse the nose by syringing with boracic acid or some other non-irritating antiseptic solution. An efficacious means of removing crusts or pus is the application of a 20 per cent. solution of hydrogen peroxide on cotton wool pledgets. This solution rapidly loosens crusts, even the large masses found in ozaena. Septic troubles following operations on the nose are, however, very rare, even in these conditions, probably because of the free drainage which is provided. It is particularly important to allow this free drainage, and the nose should never be packed unless it be urgently required for the arrest of haemorrhage; should packing be inserted, it should be removed at the earliest possible moment, at least within 24 hours, and not replaced.

THE APPLICATION OF CAUSTICS.

The **galvano-cautery** is chiefly employed for the reduction of enlarged turbinates, for the removal of small growths, and for the arrest of haemorrhage. When applied to a swollen—as distinct from a hypertrophied—inferior turbinate, considerable shrinkage may follow a single application. Other indications for its use will be given later. The objection to the cautery is that it destroys a certain amount of the ciliated epithelium, and tends to produce dryness and crusting of the mucous membrane. Also, if the septum and the outer wall of the nose be by accident simultaneously



FIG. 37.—HOVELL'S CAUTERY HANDLE.

injured and denuded of epithelium, the opposing raw surfaces are apt to come into contact when the reactionary swelling occurs, and adhesions may follow. The advantages of the cautery are, that its application is painless when cocaine is used, and the patient does not dread it, that there is no bleeding, and that the reaction after the operation is slight. It is a most valuable method of treatment when used in suitable cases and with discretion; but like other good methods, it has, undoubtedly, been used excessively, and has thus been brought into undeserved disrepute.

The instruments required are a cautery handle with several platinum points (see Fig. 37). The electric current can be obtained from an

accumulator or battery, or better still, directly from the main current by means of a transformer. The nose should be anaesthetized with suprarenal extract and cocaine as above described. This solution, by rendering the mucous membrane anaemic and shrunken, widens the inferior meatus, enables the whole of the inferior turbinate to be seen, and lessens the risk of injury to the septum. The cautery may be applied superficially by means of flat points, or a sharp point may be plunged deeply into the tissues of the mucous membrane. The latter method—the so-called sub-mucous cauterization—has the great advantage of not destroying much of the superficial epithelium, but it is apt to be followed by greater reactionary swelling and disturbances. Ultimately, however, considerable contraction takes place. The more usual method of superficial cauterization consists in drawing two or three parallel lines the whole length of the swollen turbinate. The exact method in which the cautery produces its effect when applied in this manner is unknown, but it seems certain that if swelling only of the turbinate be present permanent shrinking out of all proportion to the actual destruction of tissue will ensue. Very little should be done on each occasion, as the action of the cautery occasionally spreads far beyond the actual limits to which it is applied, and much disturbance may follow. Small superficial sloughs form over the burnt areas, and separate generally about the 7th to the 10th day, when healing rapidly takes place. Sometimes these sloughs are thick and extensive, and if removed, re-form time after time. Healing may thus be delayed for from four to six weeks. For a few hours after operation a plug of wool may be worn in the nose. The best after-treatment is the introduction of an oily preparation such as the pigment. hydrarg. nit. (see formula 23) or of simple lanolin. The lanolin should be gently warmed until fluid and then applied to the interior of the nose with a small brush or wool mop and sniffed up as far as it will go. In this way it forms a protective coating to the injured surface. If there is much discharge, an alkaline lotion may be used for two or three weeks. There is little danger of bleeding if the cautery be used gently and not at too great heat. Adhesions are often spoken of as a serious—almost an unavoidable risk, but they will never occur if care be taken to avoid simultaneous injury to the septum and inferior turbinate.

Although the cautery is so useful a means of reducing swelling of the inferior turbinate, it should never be applied to the middle. The mucous membrane in this region is intimately blended with the periosteum: periostitis and osteitis are very liable to follow its application, and to aggravate the mischief for which it was applied.

Caustics. When the galvano-cautery is not at hand chemical caustics, such as nitric acid, trichlor-acetic acid, chromic acid, or nitrate of silver may be used. The two last are best applied as beads fused upon the point of a probe. Trichlor-acetic acid or solutions of chromic acid may be applied with small pledgets of wool on a probe; nitric acid must be used with small wooden sticks or glass brushes. A little cocaine may

be first applied to the nose, but the applications are not very painful as a rule, and are followed by very little reaction. Their action is, however, a little more uncertain than that of the galvano-cautery, and it is more difficult to limit. For this reason the galvano-cautery should usually be given the preference. If caustics are used, nitric acid is probably the best. After it has been applied its action may be arrested by mopping the nose with pledgets of wool soaked in a weak solution of bicarbonate of soda. The after-treatment is the same as when the galvano-cautery has been used.

Electrolysis is very rarely used in the nose, but has been employed for the removal of tumours and septal growths. Quite recently it has been recommended in the treatment of atrophic rhinitis. If used in the latter affection one needle should be inserted into the inferior turbinate and the other into the septum. A current of 30 to 40 milliamperes may be allowed to pass for 5 to 10 minutes: if pain be produced a weaker current should be used. When applied to tumours considerable reduction in size will take place, provided the tissues are soft. When a tumour contains cartilage or bone, as in spurs or crests of the nasal septum, a much longer time and more applications are required. The method is already falling into disuse.

Arrest of Haemorrhage. The bleeding after cutting operations on the nose is often profuse, but it is generally sufficient to let the patient lie down quietly and to apply cold to the face by sponging with cold or iced water. No attempt should be made to blow the nose; sneezing, coughing, or straining should be forbidden. All food must be given cold, and in the intervals the patient may be encouraged to suck ice. In more serious cases folds of lint wrung out of iced water may be applied to the face and frequently renewed: a small piece of ice may be occasionally introduced into the nose.

If these means fail, and the bleeding is profuse, it will be necessary to pack the nose. If the blood come from the anterior part of the septum it is sufficient to introduce a plug of gauze or wool into the affected nostril and to compress the nostrils with the finger and thumb. When the haemorrhage is not too profuse, it may be arrested temporarily by applying cocaine and suprarenal extract, and then the bleeding vessels may be sealed with the electric cautery. If bleeding comes from some other known area it is well to pack the spot with a strip of gauze. If the bleeding area is unknown or extensive, as after a somewhat large operation upon the nose, it is better to pack the whole nostril. The easiest and most effective method is to pass a finger through the mouth into the post-nasal space, to introduce a long strip of gauze through the anterior nares, and to pack the nose tightly from behind forwards, the finger in the post-nasal space preventing the gauze passing through the posterior nares. The disadvantage of packing is that the removal of the gauze is liable to be followed by renewed bleeding. It should be removed gently and slowly, whilst the nose is frequently douched so as to wash rather than to pull it

away. Instead of gauze packing, a Cooper-Rose's or Howard's bag may be used (Fig. 38). This is a soft rubber bag which can be introduced into the nose and inflated *in situ*: it will be found a most effectual means of arresting haemorrhage. Plugging the post-nasal space with the aid of Bellocq's sound is happily obsolete. Whether gauze-packing or an inflatable bag be employed it should be removed within 24 hours, and the nose



FIG. 38.—HOWARD'S NASAL BAG.

cleansed, otherwise sepsis and constitutional disturbances are apt to occur.

The following articles may be consulted:

WYATT WINGRAVE. (Nasal Douches.) *Lancet*, 1902, i. p. 1373.

BRADEN KYLE. (The Use of the Suprarenal Gland.) *Therapeutic Gazette*, 1902, 3rd series, xviii. p. 438.

GOLDSTEIN. (Post-operative Treatment.) *Laryngoscope*, 1902, xii. p. 729.

Discussion on Post-operative Treatment. KREBS and others. *Journ. of Laryngol.*, 1904, xix. p. 15.

Discussion on Post-operative Treatment. SEMON and others. *Proceedings Laryngological Society of London*, 1903, xi. pp. 1-41; *Journal of Laryngol.*, 1904, xix. p. 22.

RETHI. (Post-operative Mishaps.) *Archiv für Laryngol.*, 1896, iv. p. 403.

CHAPTER IV.

NASAL OBSTRUCTION, ITS SYMPTOMS AND EFFECTS.

OBSTRUCTION to the free passage of air through the nose is one of the most frequent and important consequences of nasal disease. The obstruction may be partial or complete, periodical or constant. In complete obstruction the patient breathes entirely through the mouth, and the condition is obvious. Partial obstruction may be easily overlooked unless the patient be closely observed or questioned, when it may be found that he breathes through the mouth once in every 3 or 4 respirations; or he may state that there is obstruction in one nostril only, that sometimes one side, sometimes the other is obstructed, but never both at the same time; or there is obstruction only at night or under certain conditions such as during exercise, excitement, etc.

When chronic nasal obstruction occurs at an early age it exercises deleterious effects on the neighbouring parts, on the general well-being, and on the development and growth of the whole body. The full consequences of nasal obstruction are most frequently seen in children suffering from adenoids. It is of great importance that these effects should be thoroughly recognised, for there is still much misconception with regard to them. The evils of nasal obstruction have been grossly exaggerated in some directions, and too much importance has been ascribed to quite trivial degrees of obstruction. Operations to relieve slight defects of which the patient was totally unconscious have been so frequently performed that the whole subject has been brought into disrepute. This is very unfortunate as the full significance of some results of nasal obstruction is perhaps even yet generally unappreciated. In discussing this subject I shall attempt to be as impartial as possible.

The symptoms resulting from nasal obstruction may be divided into the following groups:

(1) *Direct effects.*

- (a) Snoring.
- (b) Alteration of voice.
- (c) Anosmia.

- (d) Difficulty in breathing through, and in blowing the nose, and its consequences.
 - (a) *Loss of the nasal functions and its effects on the nose and neighbouring organs* (see 2).
 - (β) *The open mouth and its mechanical consequences* (see 3).
- (e) Obstructed respiration during sleep, and its consequences.
 - (a) *Deficient oxygenation of the blood* (see 4).
 - (β) *Deformity of the chest walls* (see 5).
- (2) *Effects on the nose and on the neighbouring organs* from loss of nasal functions, from mouth breathing, etc.

Liability to repeated colds: chronic nasal catarrh: hypertrophic rhinitis.

Post-nasal catarrh: adenoids.

Catarrh of the Eustachian tube and middle ear, acute and chronic.

Dryness of the mouth, gums and tongue.

Early decay of the teeth.

Septic tonsillitis and pharyngitis.

Pharyngitis sicca and pharyngeal catarrh.

Laryngitis sicca and laryngeal catarrh.

Tendency to bronchitis and pulmonary affections.

Enlargement of the cervical glands.

General debility and ill health.

(3) *Symptoms due to the constantly open mouth.*

The typical facies.

Ill development of the upper jaw: high narrow palate: V-shaped alveolar arch: crowded teeth.

Deformity of the nasal septum.

Collapse of the alae nasi.

Ill development of the lower jaw.

(4) *Symptoms due to deficient aeration of the blood during sleep.*

Restless and unrefreshing sleep disturbed by terrifying dreams.

Cyanosis: profuse sweating.

Headache and languor in the mornings. Capricious appetite.

Impaired health and general malnutrition: anaemia and stunted growth.

General stupidity and inaptitude for mental exertion.

General moroseness: nervous depression: "peevishness": or listlessness.

(5) *Mechanical results of the difficulty in breathing during sleep.*

Inspiratory retraction and, ultimately, deformity of the chest walls.

(6) *Symptoms of reflex or obscure origin.*

Nocturnal enuresis.
 Hay fever and asthma.
 Laryngeal spasm.
 Laryngismus stridulus.
 Congenital laryngeal stridor.
 Persistent cough.
 Stammering, stuttering, and other defects of speech.
 Epilepsy. Epileptiform convulsions.
 Chorea.

This last group and a few other affections are often described as results of nasal obstruction. In some of them nasal obstruction may be a more or less important factor in the causation, in others when present it is simply a coincidence.

It will be necessary to consider some of these symptoms in detail especially with regard to their probable mode of causation and their treatment.

(1) **Direct Effects.** (a) **Snoring** is a very common symptom in children: it may occur during waking hours, and if the obstruction be marked is a constant feature during sleep. In adults marked nasal obstruction may exist and compel mouth breathing without any snoring whatever. Snoring in children is due to the passage of the air through the narrowed nostrils, for it has been found that when a child is asleep and snoring vigorously with open mouth, the greater part or whole of the respiratory air is passing in and out of the nose. This observation can easily be verified by holding a few strands of cotton wool in front of the child's nose and mouth while it is asleep.

(b) **Speech** is curiously altered in the way so familiar as the result of an ordinary cold. The nasal resonance is partly or entirely cut off, consequently *m*, *n*, and the sound expressed by *ing*, are difficult or impossible to pronounce accurately. They are usually replaced by *b* and *d*. In addition to this there is a flat tone about all vocal sounds due to the diminished resonance space. The voice is usually said to have a nasal quality; this of course is just what it lacks. Other defects of speech are common in children suffering from nasal obstruction, but are not actually due to the shutting off of the nose (see later).

(c) **Anosmia.** The power of smell and in a less degree that of taste for flavours is lost or diminished. In some cases this may be due to the obstruction preventing the olfactory particles reaching the sensitive area, and in other cases to the associated nasal catarrh.

(2) **Effects on the Nose and on the Neighbouring Organs.** Children, and in a less degree adults, with nasal obstruction have a great tendency to **repeated** or **chronic** colds in the head. This is probably due to insufficient nasal drainage, the obstruction preventing

proper blowing of the nose and allowing secretion to accumulate in it. The accumulation of secretion and its constant contact with the nasal mucous membrane diminish the vitality of the parts and predispose them to microbial infection. The diminution of the air stream passing through the nose, the partial abeyance of the nasal functions, and the general anaemia and ill-health so often associated with nasal obstruction, may be contributory causes. The nasal catarrh has been ascribed to the alterations in the air pressure in the nasal fossae. There is undoubtedly increased negative pressure behind the site of an obstruction during inspiration, which would produce congestion of the tissues and liability to catarrh. But children with adenoids are especially liable to repeated nasal catarrhs, and in this condition the obstruction is situated behind the nose. The repeated nasal catarrhs lead to **chronic rhinitis** and to **hypertrophy** of the **inferior turbinates**. Turbinal hypertrophy should always be looked for in old standing cases of nasal obstruction, whether the latter be primarily due to adenoids, to a deflected septum, or to other causes. **Epistaxis** is also a common symptom of nasal obstruction, and is probably dependent on the vascular congestion.

Post-nasal space. Post-nasal catarrh is frequent, possibly as the result of the diminished air pressure in the post-nasal space, but more often due to direct extension of the nasal catarrh. The frequent catarrhs lead to inflammation and hypertrophy of the lymphoid tissue normally present in this region, that is, to adenoids. Enlargement of the glands in the neck is also common as a result of repeated mild doses of septic absorption. In children suffering from adenoids a chain of small hard glands, varying in size from a pea to a small cherry, will almost invariably be felt along the posterior border of the sterno-mastoid muscles.

Mouth. The mucous membrane of the mouth is dry and the tongue is furred, especially in the morning, as the result of mouth breathing during sleep. The teeth decay early, chiefly because of their irregularity, which allows particles of food and dirt to collect and decompose in the crevices. The ill-nourished dry gums favour the growth of numerous micro-organisms.

Pharynx. There is a liability to septic inflammation of the tonsils and pharynx as the result of the direct inhalation of the dusty microbe-laden air. Repeated inflammation of the tonsils leads to hypertrophy of these glands. The posterior wall of the pharynx is often glazed with dry mucous or muco-purulent secretion. This, however, is not an invariable consequence: the tongue, especially in adults, may make a good respirator and diminish the ill-effects of mouth breathing. Pharyngeal catarrh as the result of direct extension of nasal or post-nasal catarrh or of the septic condition of the mouth is common. It is probable also that mouth breathers are especially liable to contract such affections as scarlet fever and diphtheria.

Larynx and Lungs. Acute and chronic laryngeal catarrh, and especially a dry form of laryngitis with thickening of the mucous membrane, are frequently met with, and prove very intractable until the mouth breathing has been corrected. It also seems certain that the liability to tracheitis, to bronchitis acute and chronic, to bronchopneumonia and to all lung diseases is greatly increased by the absence of the normal cleansing and warming of the inspired air. Children suffering from adenoids often have a history of recurring bronchial or pulmonary troubles.

Ears. Catarrh of the Eustachian tubes and various forms of middle ear catarrh are frequently met with in association with nasal



FIG. 39.—FACE OF AN IDIOT OF THE MONGOL TYPE, SOMEWHAT RESEMBLING THE STUPID EXPRESSION OF NASAL OBSTRUCTION. (From a photograph.)

obstruction. Repeated attacks of earache and deafness, sometimes ending in acute suppuration, are very common in children with adenoids. They are due to extension of the post-nasal catarrh and are not a direct consequence of the nasal obstruction. The indrawing of the membrana tympani, a well-marked feature in the non-suppurative cases, has been ascribed to the increased negative pressure in the post-nasal space. If the anterior nares be compressed with the fingers during inspiration a negative pressure will be created in the post-nasal space, and if the Eustachian tubes are opened, air will be sucked out of the tympanum. But if a patient with indrawn drums be carefully examined, more or less obstruction of the Eustachian tubes will always be found. It is remarkable that if the indrawing of the drums be the direct result of the negative pressure in the post-nasal space, this effect should be produced most markedly when the tubes are obstructed. Moreover, as I have elsewhere pointed out, various forms of nasal obstruction partial or complete may

exist both in adults and in children without any indrawing of the drums.¹ This latter indeed depends entirely on Eustachian obstruction and has no



FIG. 40.—TYPICAL DEFORMITY OF THE UPPER JAW PRODUCED BY PROLONGED NASAL OBSTRUCTION. Note the rotation of the central incisors, the backward displacement of the lateral incisors, the projection forward of the canines and the approximation of the second bicuspids and first molars. The axes of the teeth slope inwards. (From a cast kindly lent by J. G. Turner.)

direct connection with nasal obstruction. It is most commonly seen in adenoids where the obstruction to nasal breathing, and consequently



FIG. 41.—TYPICAL DEFORMITY OF LOWER JAW PRODUCED BY PROLONGED NASAL OBSTRUCTION. The deformity is exactly similar to, but less marked than, that occurring in the upper jaw. Compare Fig. 40. (From a cast kindly lent by J. G. Turner.)

the most marked negative pressure, is located behind the orifice of the tubes.

¹ *British Medical Journal*, 1902, ii. p. 605 (Brit. Med. Assoc. Meeting at Manchester).

(3) **Symptoms resulting from the Constantly open Mouth.**
Facial Aspect. The gaping mouth with projecting incisor teeth but half-

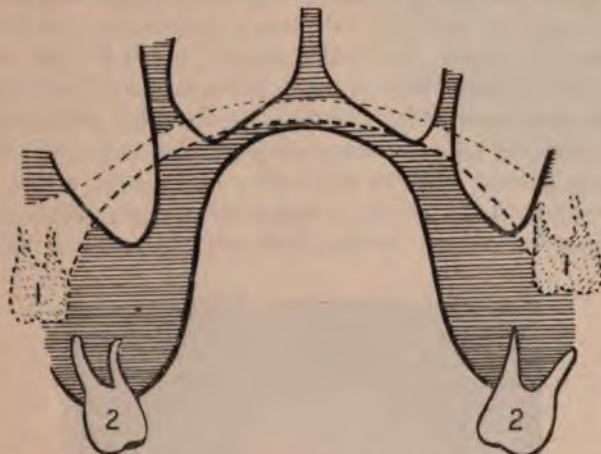


FIG. 42.—DIAGRAM ILLUSTRATING CHANGES IN SHAPE OF PALATE PRODUCED BY NASAL OBSTRUCTION. The dotted lines show the normal palatal arch, the black lines a high saddle shaped arch. (1) Normal position of the second bicuspid which is displaced to (2).

concealed by the shortened upper lip, the hanging lower jaw and the consequent obliteration of the folds of expression round the mouth give

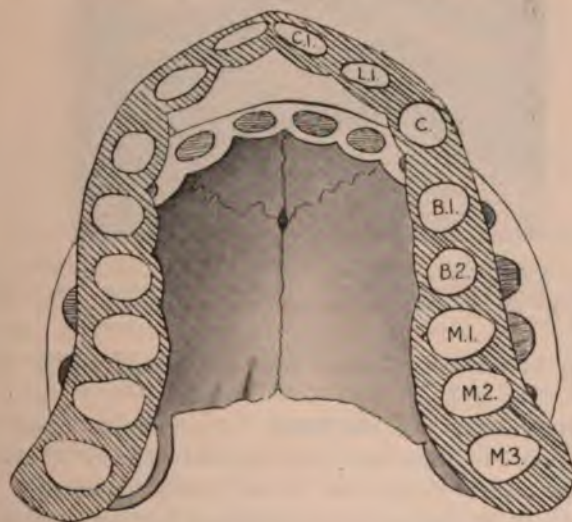


FIG. 43.—DIAGRAM SHOWING CHANGES IN SHAPE OF ALVEOLAR ARCH PRODUCED BY NASAL OBSTRUCTION. The deformed V-shaped alveolus is super-imposed on the normal horse-shoe shaped alveolus.

the patient the well-known stupid look (Fig. 52). The appearance is not unlike that of certain idiots (compare Fig. 30), a resemblance

intensified by the deafness, listlessness, and mental obtuseness so common in nasal obstruction.

The shape of the nose is altered. The alae nasi are collapsed, reducing the anterior nares to mere slits; there is a deep crease between the alae nasi and the nasal bones; the bridge appears widened as a result of the narrowing of the anterior part of the nose, or may actually be widened by swelling and congestion of the soft parts overlying the nasal bones. There is often an enlarged vein, or veins, running transversely across the root of the nose, and the soft parts in this region may appear bluish, congested, or swollen. Dark circles round or under the eyes are common, especially in the morning as a result of disturbed rest. In addition there is often



FIG. 44.—DEFORMITY OF UPPER JAW DUE TO NASAL OBSTRUCTION IN A CHILD AGED 6½. Showing commencing superior protrusion and open bite. The temporary teeth which at this age should be widely spaced are tightly crowded together. (From a photograph.)

some deformity of the nasal septum and occasionally lateral deflection of the nose itself (Fig. 47).

The Maxillary Bones and the Teeth. When chronic nasal obstruction exists in early life its effects upon the soft and actively developing bones of the face may assume proportions of the greatest importance. Although these results are most common in, and indeed are often looked upon as symptomatic of, adenoids, they may occur in nasal obstruction due to any other cause. The exact factors in their causation and even their relationship to nasal obstruction have given rise to a large amount of discussion. In the investigation of this subject I have been greatly aided by Mr. J. G. Turner.

The following changes are met with in the upper jaw: (1) The whole bone is ill-developed. (2) The arch of the hard palate is high and narrow. (3) The alveolar arch is V-shaped. (4) The teeth are crowded and irregular.

(1) The *deficient development* of the upper jaw is often marked and may be recognised even in early life. Normally, between the ages of 4 and 6 years small spaces appear between the temporary teeth. At six years old all the temporary teeth are spaced, that is, the jaw has outgrown them and is ready to receive the larger permanent teeth as they erupt. When nasal obstruction is present this spacing of the temporary teeth does not occur; they remain closely packed together, there is no room



FIG. 45.—DEFORMITY OF UPPER JAW AND CROWDING OF TEETH DUE TO NASAL OBSTRUCTION IN A GIRL AGED 17. Showing the projection forwards of the canines, and the sloping axes of the central incisors. (From a photograph.)

for the permanent set to erupt naturally, and in consequence they become crowded and irregular, as will shortly be described.

(2) The *arch of the hard palate* is *high and narrow*; sometimes it is saddle-shaped, at others steep and almost pointed. It has indeed been stated that the arch of the palate is not actually raised, but that the increased height is only apparent as a result of the lateral approximation of the alveolar processes. It is impossible to decide this point without making very accurate measurements of a large series of cases. But the frequency with which deflection of the septum is associated with this deformity indicates that there often is actual elevation of the palate. For if the palate be actually raised, the floor of the nose must also be raised; this would diminish the vertical diameter of the nasal fossa, and cause crumpling of the nasal septum. The appearance of a high-arched palate could also be produced in another way: not by actual elevation of the centre of the palate, but by a downward and inward displacement of

the lateral parts of the arch, that is, of the alveolar processes (see Fig. 48). This would bring the molar and the bicuspid teeth on a lower level than normal, and would produce an "open-bite," for the molar teeth of the upper jaw being on a lower plane than the incisors, would come into contact with those of the lower jaw before the front teeth met. Now an open bite is also frequently seen in prolonged nasal obstruction, and if this be the true explanation, the centre of the palate will not be raised, the nasal fossa will attain its full vertical development, and there will be no deflection of the septum. Although at present I have made too few



FIG. 46.—DEFORMITY OF UPPER JAW AND CROWDING OF TEETH PRODUCED BY NASAL OBSTRUCTION IN A GIRL AGED 18. Showing backward displacement of lateral incisors and rotation of central incisors and canines. (From a photograph.)

observations to be sure that this relationship is constant, I have frequently observed it. I am therefore inclined to believe that in some cases the centre of the palate is actually raised, when the nasal septum is deflected; and that in others the lateral parts of the arch are drawn downwards and inwards, when there is an open-bite, but no deflection of the septum. The open-bite may sometimes be due simply to deficient development of the anterior part of the upper jaw.

(3) *The alveolar arch becomes V-shaped.* The normal alveolus is shaped like a horse-shoe, the first molar being at the widest part of the arch. In nasal obstruction the front of the arch usually becomes pointed, and the sides run almost straight back from the incisor teeth to the first molar. The second and third molars, which develop later, when the mouth

breathing may have passed off, are often further apart (Figs. 40 and 43), or the third molar may be unable to erupt, owing to the ill-development of the upper jaw. The central incisors are pushed forward and project in front of the lower teeth, producing the over-hung bite; they are usually but half-concealed by the shortened upper lip. The shape of the alveolus is strongly suggestive of lateral compression of the arch; the pressure is apparently most strongly applied over the region of the second bicuspid or the first molar.

(4) *The teeth are irregular and crowded.* The central incisor teeth are often rotated, so that their posterior surfaces look inwards instead of back-

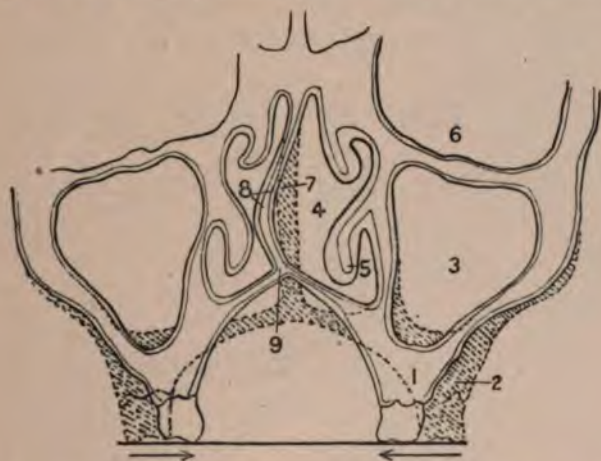


FIG. 47.—DIAGRAM SHOWING THE FORMATION OF THE HIGH NARROW PALATE AND THE DEFORMITY OF THE NASAL SEPTUM RESULTING FROM NASAL OBSTRUCTION. The dotted lines indicate the normal; the plain black lines, the deformed upper jaw. 1, Alveolus at the site of the first molar displaced inwards from its normal position at 2; 3, antrum; 4, middle meatus; 5, inferior turbinate; 6, orbit; 7, normal straight septum; 8, deflection of the septum consequent upon the increased elevation of the palate; 9, hard palate in its abnormal position. The arrows indicate the line of action of the compressing force. Compare Fig. 48.

wards; they may partly overlap each other. The lateral incisors are sometimes developed posteriorly to the other teeth, that is, they retain their foetal position, and never come forward into their normal places. The canine teeth may project in front of the other teeth: they are never developed posteriorly, as is sometimes stated. The axes of all the teeth, even the molars, slope inwards towards the mouth, and many of the teeth overlap in an irregular manner. These irregularities permit particles of food to collect between the teeth, and predispose to their early decay. The dry state of the gums and mouth caused by the mouth breathing increases this tendency.

The changes in the shape and in the teeth of the lower jaw are similar to those of the upper. There is the same tendency to lateral compression of the alveolar arch, the whole bone is usually ill-developed, and the teeth are crowded. Protrusion of the lower incisor teeth is,

however, rarely seen, and on the whole the changes are less marked than in the upper jaw.

Causation. The whole shape of the upper jaw, the narrowness of the palate and of the alveolar arch, the over-hung bite due to the anterior part of the alveolar arch being thrust forward, and the frequent deflection of the nasal septum due to the increased height of the palate, are all strongly suggestive of lateral compression of the jaw. There is evidence that this lateral compression may result from increased tension of the soft tissues of the cheeks, which are put upon the stretch by the open mouth. The actual compressing force exerted by this tension is of course very slight, but it must be remembered that it often continues in action during all the time that the bones of the upper jaw are soft and actively developing.

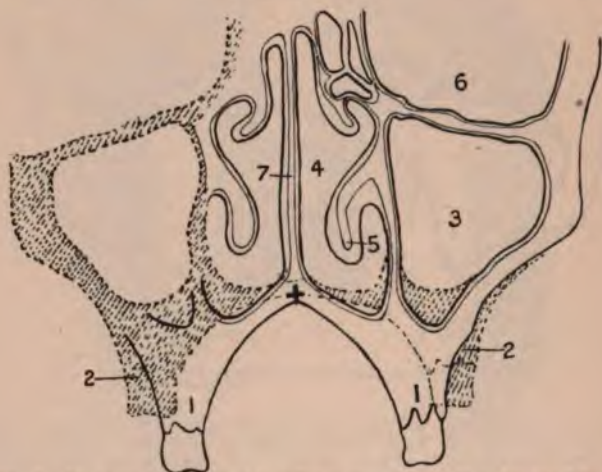


FIG. 48.—DIAGRAM ILLUSTRATING THE FORMATION OF THE HIGH NARROW PALATE AND OPEN BITE RESULTING FROM NASAL OBSTRUCTION. The plain black lines illustrate the deformed jaw, the dotted lines the normal development. As the result of lateral compression the alveolus at the position of the first molar tooth (2) is pushed inwards and downwards towards (1), the cross on the palate indicates the point which acts as a pivot. As a result of this the upper molar teeth are on a lower level than normal, they come in contact with the corresponding teeth in the lower jaw before the front teeth meet, and produce an open bite; 3, antrum; 4, middle meatus; 5, inferior turbinate; 6, orbit; 7, the septum which in this case is not deflected. Compare Fig. 47.

It is only when the mouth breathing persists for years that it produces any deformity. It is difficult to see what else could produce this lateral compression. Moreover, it is apparently the only cause which could act equally on both upper and lower jaws, both of which are undoubtedly affected by mouth breathing. I have recently had a case under my care which seems to demonstrate conclusively the above theory. The patient was a boy aged 12. He had nasal obstruction, necessitating mouth breathing, and both the upper and lower jaws were deformed. He had had facial paralysis on the left side since two years of age: the soft parts on this side of the face were consequently flaccid, the right side of the face was normal (Fig. 49). In this case the arch of the palate was high and

narrow, the teeth on the right side were irregular and crowded, those on the left side were normal. The right central incisor was rotated, so that its posterior surface looked inwards, and its axis sloped inwards. The right lateral incisor was on a posterior plane to the central. The alveolar



FIG. 49.—UNILATERAL DEFORMITY OF UPPER AND LOWER JAWS RESULTING FROM NASAL OBSTRUCTION AND UNILATERAL FACIAL PARALYSIS IN A BOY AGED 12. The tension of the right cheek and the flaccidity of the left cheek when the mouth is open are well shown. The deep crease in the right cheek corresponding to the site of the greatest tension is opposite the greatest deformity, which, as shown in Fig. 50, is limited to the sound, that is the non-paralysed, side. (From a photograph.)

arch on the right side was flattened in both upper and lower jaws, running in an almost straight line from the incisor teeth to the first molar. On the paralysed side there was little or no deformity of the alveolus or teeth (Fig. 50). The only apparent factor in this case which could cause a difference between the two sides was the facial paralysis, which removed the tension of the cheeks on the paralysed side. Still a single case may be a mere coincidence; more or less unilateral deformity is occasionally seen without any obvious cause.

The anterior protrusion of the upper incisor teeth is probably due in

part to the loss of the constricting influence of the upper lip. In mouth breathers the upper lip appears to be shortened and retracted, whereas normally it covers the teeth, and by its elasticity keeps them in position. If an elastic band be fixed over the teeth, as is often done by dentists, the deformity can readily be overcome.

Three other possible contributory causes may be mentioned. It is obvious that when the upper and lower teeth are in contact, there is a constant pressure on the extremities of the palatal arch, which tends to flatten it out. When the mouth is open this pressure is removed, and one factor in the normal development of the arch is absent. Secondly, when the mouth is closed, the tongue is in contact with the hard palate,



FIG. 50.—UPPER JAW OF PATIENT SHOWN IN FIG. 49. SHOWING UNILATERAL DEFORMITY OF ALVEOLUS. (See Text.) (From a cast kindly made by J. G. Turner.)

except for a small space near its centre (Fig. 51). At this spot a partial vacuum is formed, which helps to retain the closure of the mouth without muscular action, and at the same time tends to depress the centre of the palate. Lastly, the contact of the tongue with the alveolus all round the upper jaw produces a lateral outward pressure, which tends to widen the arch.

The factors producing the deformity in the lower jaw are probably two in number: the lateral compression produced by the tension of the cheeks, as above explained, and the lateral pull of the mylohyoid muscle. This muscle is probably always in a state of active contraction to maintain the open mouth, and the position it assumes in mouth breathers, as shown by section of a frozen skull, makes the floor of the mouth V-shaped. The lateral pressure of the tongue, which remains in contact with the lower jaw, may serve to expand the alveolar arch, and thus to prevent such great deformity as occurs in the upper jaw.

These deformities of the jaws and teeth were apparently first noted by Robert¹ in 1843. They were accurately described by Tomes,² who considered them due to mouth breathing, as the result of enlarged tonsils. Michel, in 1876, first ascribed them to adenoids. Other observers, Morell Mackenzie, MacDonald, Siebenmann and his followers, considered the

¹ *Bulletin général de Thérapeutique*, 1843.

² *A System of Dental Surgery*, 1873, p. 140.

deformities due to some inherited tendency. Recent writings on the subject show that a great diversity of opinion still exists. Bloch considers that the high palate is a constant symptom of adenoids, and that it is due partly to the lateral compression of the cheeks, and partly to the impact of the air on the hard palate in mouth breathing. Korner agrees with this, and adds as an additional cause, that the nose having no function to perform, fails to develop properly. Bentzen, as the result of numerous measurements, found that the palate in adenoids was much higher than normal,



FIG. 51.—SECTION THROUGH A FROZEN SKULL TO SHOW SPACE BETWEEN ROOF OF TONGUE AND HARD PALATE WHEN THE MOUTH IS CLOSED. 1, Antrum; 2, inferior turbinate; 3, space between tongue and palate, probably a partial vacuum; 4, nasal septum; 5, tongue. (After Cryer.)

and that the longer oral respiration persisted, the higher the palate became. The presence or absence of rickets apparently made no difference. Alkan's elaborate measurements and investigations on the development of the skull led him to the same conclusion. On the other hand, Buser measured 514 skulls and concluded as Siebenmann, Swain, and others had done that the high-arched palate and its associated deformities depended entirely upon leptoprosopia, and that it was hereditary. He considered that the palate in adenoid cases was not higher than normal, and explained the constant association of palatal deformity with mouth breathing, by stating that adenoids and other obstructions naturally more often gave rise to mouth breathing in subjects with leptoprosopic heads than in others. Grosssheintz considers the deformities mainly due to racial peculiarities. Mayo Collier, who has no hesitation in ascribing the deformities of the jaw to the results of mouth breathing, considers that the air in passing through the mouth sucks air out of the nose, and thus produces a negative pressure in the nasal fossa, which causes a sinking-in of the surrounding parts. This theory overlooks the

fact that the seat of obstruction is usually situated behind the nasal chamber, and further, that the nasal fossae are open in front, so that air can easily enter and equalise a negative pressure. It entirely fails to explain the cases of posterior choanal atresia, in nearly all of which there is a very high narrow palate, although the anterior nares may be normal (Haag). Arbuthnot Lane states that the deformities of the bones of the face are due to the absence of the lateral pressure exerted by the air in passing through the nose and naso-pharynx. Both these theories entirely disregard the existence of corresponding deformity in the lower jaw. Macdonald and Parker consider the deformity of the upper jaw the result of some inherited tendency, and add that by contributing to the narrowness of the nasal fossae, it produces negative pressure behind the nose, and so encourages hypertrophy of the adenoid tissue in the post-nasal space.

Thus most observers agree that the deformities in question are frequently, if not invariably, associated with mouth breathing. Ziem's experiments demonstrate conclusively that they may result from it. He obstructed the nostrils of puppies and other young animals, and found that great deformity of the bones of the face resulted in later life. There seems every reason to believe that the nasal obstruction precedes and causes the facial deformity. The latter is never congenital, but it follows after years of mouth breathing; the changes can be arrested, and will even retrogress, if the cause be removed. That the palatal deformities are more common in leptoprosopic patients, is easily explicable. Adenoids and all other forms of nasal obstruction are more commonly met with in people with leptoprosopic, than in those with chamaeprosopic heads. Moreover, adenoids, when present in the former, are more likely to produce nasal obstruction than when occurring in the latter, and it is the open mouth, and not the mere presence of adenoids which counts. Thus the evidence shows that these deformities really depend upon mouth breathing, and that the increased tension of the soft tissues of the cheeks is the most important factor in their causation.

(4) Symptoms due to Deficient Oxygenation of the Blood. In children with nasal obstruction there is a marked diminution in the volume of air entering the chest during sleep, and in consequence, the blood is insufficiently oxygenated. The small amount of air passing in and out of the lungs is easily demonstrated by watching the child's breathing. If a case of marked nasal obstruction be carefully observed it will be noticed that during sound sleep, air enters the chest only once out of every four, five or more respiratory movements. I have recently observed a child in which the inspiratory efforts during sleep produced retraction of the chest walls without any snoring and without any air whatever entering the chest. After 11 or 12 such attempts to breathe the child partially aroused himself, gasped, drew one long breath, and subsided into sleep again. During sleep this child was always deeply cyanosed and bathed in profuse perspiration.

Disturbed Rest and Sleep. The results of this deficient oxygenation

of the blood are very marked. Sleep is not restorative, and the patient wakes up in the morning tired, fretful, complaining of headache, and looks ill and dark round the eyes. Often sleep is disturbed by terrifying dreams, and the child suddenly wakes up shouting and screaming. Many children have exactly the same dream every night, and are so frightened that they are often afraid to go to sleep. These "night terrors" are probably in many cases the direct result of partial suffocation.

In severe cases the difficulty in breathing may lead to **cyanosis** and profuse **sweating**. These symptoms may give rise to considerable alarm, and it is probable that tracheotomy has more than once been performed for their relief. The seat and cause of the obstructed respiration may, however, be readily recognised by waking the patient, when it will be found that the difficulty in breathing and the cyanosis will at once disappear.

Nervous Symptoms. Nasal obstruction produces, both in adults and in children, a peculiar group of nervous symptoms, to which the term *aproxexia* was applied by Guye. They consist of inability to fix the attention or to undertake anything requiring close mental application. Even simple arithmetical calculations may become impossible. There is often a considerable degree of stupidity, the memory may be impaired, and it becomes difficult to transact business. The disposition may be altered; adults become nervous, irritable, or morose; children fretful, languid, and unwilling to work or play. In children these symptoms are largely due to the deficient oxygenation of the blood, the restless sleep, and the impaired general health. The night terrors are also an important factor, and may render children highly nervous. Guye ascribed the train of symptoms to interference with the lymphatic outflow from the brain as the result of the circulatory changes in the nasal cavity. It must be remembered that there is a direct connection between the lymphatics of the brain and its membranes and those of the ethmoidal region, and it is a frequent clinical observation—which goes far to confirm this view—that the symptoms in adults are more pronounced when the cause of the nasal obstruction is seated in the ethmoidal region. The patient's stupidity is emphasised by the silly expression resulting from the open mouth, etc., and the air of abstraction due to the deafness.

Effects upon the General Health. From what has already been said, it will not be difficult to understand that nasal obstruction produces the most baneful effects upon the general health. The disturbed rest, the imperfect oxygenation of the blood during sleep, the frequent catarrhs of the upper air passages associated with mild febrile attacks due to septic absorption, the ill-development of the jaws and teeth, the deformities of the chest walls, together with the other consequences of the loss of the functions of the nose and the harmful effects of mouth breathing, will readily explain this. Children become anaemic, stunted, and ill-developed, and are always ailing. The increase of bodily and mental activity and

the rapidity of growth following a successful operation are frequently surprising.

(5) **Deformity of the Chest Walls due to Obstructed Respiration during Sleep.** Children with adenoids or other form of nasal obstruction will often be found to have some deformity of the chest. There may be flattening of the sides of the chest, with projection forwards of the sternum—the typical pigeon-breast (Fig. 52). This may be associated with a depression in the epigastric region. In the other variety there is a shallow depression running round the lower ribs,—Harrison's sulcus, which is often

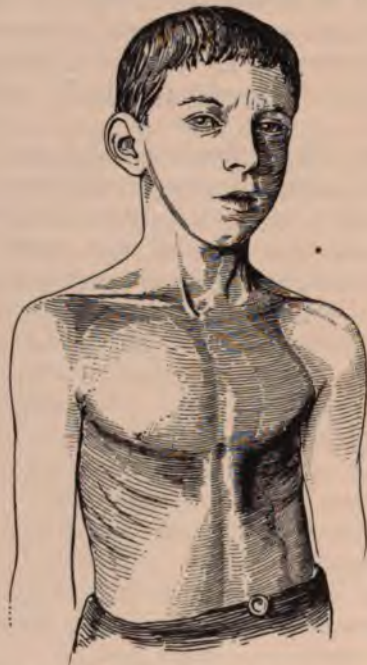


FIG. 52.—DEFORMITY OF CHEST AND FACIAL EXPRESSION RESULTING FROM PROLONGED NASAL OBSTRUCTION. (From a photograph.)

associated with a deep depression over the lower half of the sternum (Fig. 53). One or other of these deformities is very common in young children with marked nasal obstruction, and the explanation is simple. Although the child sleeps with its mouth open, careful observation will show that respiration is carried on almost entirely through the obstructed nose (Macdonald and Parker). This fact may be easily tested by holding a fine film of cotton wool in front of the nostrils and mouth of the sleeping child. Macdonald ascribed this to an "overpowering instinct" for nasal respiration which asserted itself in the young during sleep. MacKeown pointed out the fallacy of this, and suggested a purely mechanical explanation, viz. that during sleep the tongue falls back in contact with the palate and obstructs the passage through the mouth. If the chest walls

be observed during deep sleep, it will be found that at each inspiration there is recession of the anterior triangles of the neck, of the supra-sternal and supra-clavicular fossae, of the lower part of the sternum and of the lower ribs. The more marked the nasal obstruction the deeper the sinking in of these regions. The effect of this in time becomes permanent. If the bones are strong there will probably be a depression in the lower sternal region and around the chest near the insertion of the diaphragm.



FIG. 53.—DEPRESSION OF CHEST IN LOWER STERNAL REGION PRODUCED BY PROLONGED NASAL OBSTRUCTION. (From a photograph.)

If, on the other hand, the bones are soft,—and rickets from malnutrition is a common complication of adenoids in infants,—there will be flattening of the sides of the chest and the well-known “pigeon” breast. The association of “pigeon” breast with enlarged tonsils was pointed out long ago by Dupuytren. Of course adenoids were unknown at that time, and it is now well recognised that the “pigeon” breast is not due to the enlarged tonsils, which by themselves would produce little if any obstruction to respiration, but to the adenoids, which are almost invariably present when the tonsils are much enlarged. These deformities are among the most serious results of nasal obstruction. It can easily be understood

that, acting in association with the general ill-health and the constant catarrhs of the upper air passages, they render the patient susceptible to diseases of the chest.

(6) Symptoms of Reflex or Obscure Origin. Nocturnal Enuresis. It is generally recognised that nocturnal enuresis is often associated with adenoids or other form of nasal obstruction in children, and that the removal of the latter condition frequently effects a cure. Grönbech¹ records 23 cases, of which 12 were cured at once and five were improved. The exact factors in the production of the enuresis are open to dispute. It is probably the result of the deficient oxygenation of the blood during sleep leading to mild asphyxia which, as is well known, produces contraction of the involuntary muscular fibres. But whatever the relationship may be the frequent association of nocturnal enuresis with nasal obstruction is undoubted. It is of course not the only cause. In many cases of enuresis there is no nasal obstruction, and even when the latter condition is present in a marked degree its removal may have no beneficial effect.

Laryngeal Spasm. If a child with severe nasal obstruction be observed during sleep it may sometimes be noted that as the snoring increases and becomes louder and louder a distinct laryngeal note is added to the stertor. It is probable that the partial asphyxia induces some laryngeal spasm. The stridor subsides immediately the child wakes and breathes through the mouth. Occasionally severe attacks of laryngeal spasm occur during sleep. These probably depend upon mild forms of laryngitis or so-called laryngitis stridulosa. Thus the nasal obstruction is only an indirect cause.²

Laryngismus Stridulus is primarily due to rickets or to some other cause of instability of the general nervous system, although it is possibly more frequent in children who suffer from nasal obstruction than in others.

Congenital Laryngeal Stridor was first ascribed to adenoids by Eustace Smith,³ whose views were at once contradicted by McBride. I have elsewhere, in association with Dr. Sutherland,⁴ demonstrated the pathology of this affection, and have shown that it depends upon a congenital deformity of the larynx and is in no way due to nasal obstruction. These views have been confirmed by John Thomson and Logan Turner.⁵

Hay Fever and Asthma may be met with in association with nasal obstruction, but their exact relationship is difficult to understand. Many cases of hay fever may undoubtedly be cured by removing the nasal obstruction, and the affection may recur when for any reason the

¹ *Archiv für Laryngol.*, 1895, ii. p. 214.

² Lack, *Journ. of Laryngol.*, 1898, xiii. p. 303, also Hutchison, *Clinical Journal*, 1903-4, xxiii. p. 361.

³ *Lancet*, 1898, i. p. 783.

⁴ *Lancet*, 1897, ii. p. 653, and *Lancet*, 1898, i. p. 894.

⁵ *Brit. Med. Journal*, 1900, ii. p. 1561.

obstruction returns. The same sequence of events may be observed in asthma. Thus I have seen a case in which the removal of adenoids completely relieved severe asthma until recurrence of the adenoids took place. A second operation again afforded complete relief until nasal obstruction returned as a result of hypertrophic rhinitis. A third time free nasal respiration was restored with complete relief to the asthma. Bosworth went so far as to ascribe all cases of asthma to nasal obstruction. This view cannot be accepted, although it seems certain that nasal obstruction may be an occasional factor. This important subject will be fully discussed later (see Chap. XIV.).

Cough. A persistent, dry, irritable, or barking cough unaccompanied by expectoration is a frequent symptom of adenoids or other form of nasal obstruction. The cough may recur every minute or so and be extremely annoying to the patient and to his friends. It has been ascribed to a reflex, but very probably it depends upon some direct irritation of the pharynx or larynx as the result of mouth breathing. It is usually cured immediately the obstruction is removed.

Stammering. Stammering and stuttering are frequently seen in association with nasal obstruction from any cause, and are extremely difficult to cure until the obstruction is removed. The nasal condition is however only one of the factors in the production of the stammering, and removal of the obstruction alone will not effect a cure.

Epilepsy. Epileptiform* convulsions, in some cases so severe as to simulate epilepsy, have been ascribed to nasal obstruction. These spasmodic attacks occur only during sleep and are undoubtedly due to partial asphyxia. True epilepsy may of course be associated with nasal obstruction, and it is quite probable that, owing to the beneficial effect upon the general health resulting from the removal of the adenoids or other obstruction, the epilepsy will be benefited, although the affections are entirely distinct and independent of each other. Some remarkable examples of this are upon record. Jousset¹ records two cases cured by the removal of nasal obstruction due in one to a septal spur, in the other to hypertrophic rhinitis. Root² reports a similar case, and Grosskopf³ cured a man with epilepsy of 16 months' duration by the removal of nasal polypi. Lennox Browne⁴ records two cases in which small doses of potassium bromide completely controlled the fits after removal of nasal obstruction, although larger doses had previously been given without effect. StClair Thomson⁵ records a cure of chronic epilepsy by the removal of adenoids. The fits ceased shortly after the operation, and had not recurred for three years (see also Chap. XXIV.).

¹ *Rev. Heb. de Laryngol.*, 1902, xxii. p. 305.

² *New York Medical Journal*, 1898, lxvii. p. 716.

³ *Arch. für Laryngol.*, 1902, xiii. p. 140.

⁴ *Journal of Laryngology*, 1900, xv. p. 661.

⁵ *Practitioner*, 1905, lxxiv. p. 630.

Chorea is another of the nervous affections, cures of which have been reported by the removal of nasal obstruction. The affection has certainly no direct connection with nasal obstruction, and the benefit which is often obtained by nasal operation, may most probably be ascribed to the resulting improvement of the general health.

References.

Deformities of Jaws and Teeth.

- TOMES. A System of Dental Surgery. London, 1873, pp. 117-239.
 HOPMAN. Deutsch. med. Wochenschr., 1885, xi. p. 572.
 SCHAUS. Archiv für klin. Chir., Bd. xxxv. p. 147.
 ZIEM. Monatschr. für Ohrenheilk, 1888.
 WATSON WILLIAMS. Journ. of Laryngol., 1897, xii. p. 74.
 ESCAT. Archiv Internat. de Laryngol., 1896.
 BLOCH. Die Path. u. Therap. der Mundathmung, 1889, pp. 66-68.
 PARKER. Post-nasal Growths. London, 1894.
 MAYO COLLIER. Lancet, 1895, ii. pp. 1170 and 1189, and 1902, ii. p. 1038.
 WALDOW. Archiv für Laryngol., 1895, iii. p. 233.
 GLEITSMANN. Journ. of Laryngol., 1897, xii. p. 357.
 SIEBENMANN. Münchener med. Wochenschr., 1897, xlv. p. 983.
 GROSSHEINTZ. Archiv für Laryngol., 1898, viii. p. 395.
 HAAG. Archiv für Laryngol., 1899, ix. p. 1.
 ALKAN. Archiv für Laryngol., 1900, x. p. 441.
 LANE and discussion. Brit. Med. Journ., 1902, ii. pp. 687 and 692.
 BARTH. Archiv für Laryngol., 1903, xiv. p. 89.
 BENTZEN. Archiv für Laryngol., 1903, xiv. p. 203.
 BUSER. Archiv für Laryngol., 1904, xv. p. 503.
 SWAIN. Boston Med. and Surg. Journ., 1904, cli. p. 273.
 LACK and discussion. Proc. Laryngol. Soc. of London, 1905, April.
 KÖRNER. Zeitschr. für Ohrenheilk, 1891, xxi. p. 116.
 LÖWY. Berlin. klin. Woch., 1886, p. 816.

CHAPTER V.

GENERAL CONSIDERATION OF SOME SYMPTOMS OF NASAL DISEASE.

Alterations in the nasal secretion—Cerebro-spinal Rhinorrhoea—Rhinitis Caseosa—Collapse of the Alae Nasi and its treatment—Epistaxis, its varieties, etiology and treatment—Headache and Neuralgia—Influence of nasal disease on the adjacent organs, Pharynx, Ears, Larynx, Lungs, Eyes, etc.—Anosmia, its varieties, etiology and treatment—Parosmia—Hyperosmia.

APART from local symptoms, diseases of the nose may produce far-reaching effects on other organs and on the general health and development of the whole body. In view of their importance these effects demand somewhat detailed consideration. Other symptoms require discussion as to their etiology and treatment quite apart from the diseases which cause them. Again, some symptoms only remotely suggest their origin in a nasal affection, and thus their true cause is in danger of being overlooked. For these reasons, and also to save repetition, it seems advisable to consider in a general way some of the more prominent symptoms of nasal diseases.

ALTERATIONS IN THE NASAL SECRETION.

The nasal secretion in disease may be altered in character or in amount. In health whilst pure air is breathed the secretion is almost unnoticeable: the little that forms is swept by ciliary movement backwards towards the post-nasal space and swallowed. If the secretion becomes deficient the nasal mucosa is often covered with mucous crusts and dust deposited from the inspired air. This condition is met with in rhinitis sicca, and occasionally in hypertrophic rhinitis. It may also be produced by the too free use of the galvano-cautery, or follow operations on the turbinates or septum in which much mucous membrane has been removed.

Much more commonly the nasal discharge in disease is increased. It may be clear and watery, as in the early stages of an acute cold, in

paroxysmal rhinorrhoea or vasomotor rhinitis, and sometimes in nasal polypus. The amount of fluid which may pour forth from the nose is astonishing. It may amount to several ounces or to a pint or more in a day. The patient may use 10 to 15 handkerchiefs a day or he may state that the discharge is so profuse that handkerchiefs are of no use to him. This clear watery secretion is of low specific gravity and contains traces of mucin, albumen and salts. It is probably secreted to a large extent by the racemose glands (Heidenhain). In this connection also may be mentioned a very rare disease, the chief feature of which is the constant discharge of cerebro-spinal fluid from the nose.

In the majority of nasal affections the discharge is mucous or mucopurulent. This is seen in the later stages of a "cold" and in most forms of chronic rhinitis. The secretion contains pus cells and degenerated epithelium, that is cells which have undergone mucous degeneration, together with fluid secreted by the glands.

A purulent discharge from the nose points to a severe acute infection such as fibrinous rhinitis, or, when chronic, to ulceration or new growth, to the presence of a sequestrum or foreign body, or to suppuration in one of the accessory cavities communicating with the nasal fossae. Whenever pus or even a mucopurulent secretion is present in the nose it should never be assumed that the discharge is derived from the general surface of the mucous membrane until every local source, and especially accessory sinus suppuration, has been eliminated. This point will be further insisted upon later (see Chap. XVIII.).

Formation of Crusts and Foetor. When a mucopurulent or purulent secretion is associated with undue width of the nasal fossae, when too little fluid is secreted so that the discharge is unduly tenacious, and especially when the cilia of the epithelium are extensively destroyed, the discharge is apt to collect in the nose and to evaporate and form crusts. When the crusts are retained for a long time they are apt to undergo decomposition and to give rise to intense foetor of the breath. The nasal secretions may also be retained in the nose by a foreign body or sequestrum, or they may collect in one of the accessory cavities such as the antrum and undergo decomposition. The foetor of the discharge differs in various affections, but it is doubtful upon what the differences depend. Various bacteria are found in the discharges, but no definite organism can be associated with a particular stench. It is very probable that differences in the chemical composition of the fluids secreted in various affections give rise to different chemical products of decomposition. This subject will be again referred to in discussing the causation of ozaena (see Chap. X.). Foetor of the breath may occur in ozaena, in ulceration of the nose due to syphilis, tubercle, or malignant disease, when a foreign body, sequestrum, or rhinolith is present, and in some affections of the accessory sinuses, especially in antrum suppuration. Occasionally foetor may arise when crusts form upon an operation wound or ulcer, or upon

the scarred surfaces which result. Of course intense foetor of the breath may arise from many other affections. Thus it may be due to ulceration or to new growths of the tongue, mouth, throat, post-nasal space, etc. Carious teeth, diseases of the gums and tonsils are fertile causes, and more rarely affections of the stomach or of the lungs, such as bronchiectasis and pulmonary cavities, may give rise to the most intense foetor. Care must be taken to exclude these sources before ascribing the foetor to disease in the nose.

Remote Effects of Nasal Discharge. Discharge from the anterior nares may produce eczema of the vestibule, swelling, redness and excoriation of the upper lip, especially in children or in people with delicate skin. When the discharge is profuse the whole tip of the nose is apt to become red, inflamed, and excoriated. When the discharge is purulent, impetiginous pustules may form on the face and be conveyed thence to the fingers, etc. The eyes may be affected, especially in children: conjunctivitis and blepharitis are common. Occasionally the discharge from the anterior nares may be the starting point of erysipelas, or, more commonly still, of recurring attacks of pseudo-erysipelatous erythema. Discharge going back into the throat produces post-nasal catarrh with constant hacking cough, pharyngitis, laryngitis, dyspepsia, etc. These troubles will be further discussed later.

CEREBRO-SPINAL RHINORRHOEA.

This is a very rare affection characterised by the discharge of cerebro-spinal fluid from the nose. The etiology is unknown. Special attention has been drawn to it by StClair Thomson,¹ who showed a case at the Laryngological Society of London in November, 1896. The patient was a woman aged 23, who for 2½ years had suffered from a profuse watery discharge from the nose; as much as 30 drops could sometimes be collected in 5 minutes. An analysis by Hewlett and Halliburton showed that the secretion possessed the characteristics of cerebro-spinal fluid. The flow from the nose was usually intermittent, and varied at different times of the day and under varying conditions. Thomson collected from medical literature reports of several similar cases, in most of which the true nature of the affection had been overlooked. Cerebral symptoms such as severe headaches, optic neuritis, optic atrophy and nystagmus, were common. The headache was usually relieved by a free flow. Most of the recorded cases ended fatally: a few apparently recovered spontaneously.

For further particulars see

"The Cerebro-Spinal Fluid, its Spontaneous escape from the Nose."
STCLAIR THOMSON, London, 1899.

KORNER. *Journ. of Laryngol.*, 1899, xiv. p. 153; and *Archives of Otology*, 1898, xxvii. p. 397 (reports eight cases).

¹*Journ. of Laryngol.*, 1897, xii. p. 50.

RHINITIS CASEOSA.

Rhinitis caseosa was first described by Duplay in 1874. It is a rare affection characterised by the accumulation of a thick putty-like mass of secretion in the nose. The patient complains of nasal obstruction with more or less purulent or watery and intensely foetid discharge. On examination the affected nostril is seen to be filled with a putty-like mass embedded in red, easily bleeding, granulations.

The etiology is at present doubtful. Massei¹ considers it is due to the retention of pus in the nose as the result of some obstruction, and to the development of streptothrix alba in the retained secretion. Dundas Grant has described it as cholesteatoma of the nose. Many observers have found it associated with sinus suppurations. Hill² describes a case in which the caseous discharge filled the inferior meatus of the nose and the antrum, and in which a rhinolith was present. Michel³ describes three cases, in two of which there was sinus suppuration, and in one a foreign body was present. He has collected 49 cases from various sources, in 14 of which sinus suppuration was demonstrated, and in 14 others rhinoliths, polypi, or other definite cause of nasal obstruction was present. The cause in the other cases was doubtful. Arslan⁴ records seven cases, in five of which there was suppuration in the antrum, and in two a foreign body was present. The disease may cause extensive ulceration and necrosis. I have seen one patient in whom there was necrosis of the outer wall of the nose opening into the antrum; the latter was full of caseous material, and its anterior wall was perforated, causing an abscess in the cheek. There was also necrosis of the floor of the nose, and an abscess in the roof of the mouth. Similar cases with external signs are recorded by Stelda.⁵ Analyses of the putty-like material by Wingrave⁶ showed fatty degeneration of the pus. This has been contradicted by Edmunds.⁷

The pathogenesis of the affection must therefore at present remain doubtful. Generally there has been antrum suppuration or other definite source of pus, with obstruction to the outflow of the discharge, which for some unknown reason has undergone a change into putty-like material. Possibly the streptothrix alba plays a part in this transformation, as Guarnacia first pointed out.

Treatment. The treatment consists in removing the discharge from the nose. Cocaine and suprarenal extract should be applied as an anaesthetic and to reduce the swelling as far as possible. Then some of the inspissated material may be scooped away with a blunt hook or small spoon; subsequently the nose should be well syringed until all the matter

¹ *Journ. of Laryng.*, 1897, xii. pp. 146 and 478.

² *Journ. of Laryng.*, 1897, xii. p. 249.

⁴ *Journ. of Laryng.*, 1899, xiv. p. 373.

⁶ *Journ. of Laryng.*, 1904, ii. p. 272.

³ *Journ. of Laryng.*, 1901, xvi. p. 436.

⁵ *Arch. of Otolology*, 1903, xxxii. p. 356.

⁷ *Brit. Med. Journ.*, 1905, i. p. 180.

has been washed out. In simple cases this suffices to effect a cure, the granulations subsiding as soon as the cause has been removed.

If after a week any discharge from the nose continues, the antrum should be explored. The more severe cases, in which there is necrosis, or an abscess either in the cheek or the mouth, require more radical methods. The abscess must be laid open and its contents washed out; it is often necessary to perform a radical operation on the antrum. The prognosis is good, the nose usually returns to a normal condition, and there is apparently no tendency to recurrence.

COLLAPSE OF THE ALAE NASI.

Collapse of the alae nasi is a not uncommon reason of the persistence of nasal obstruction after the primary cause has been removed. The anterior nares become narrow slits, the alae nasi appear quite flaccid and the nostrils collapse, instead of expanding, on inspiration. It is probable that the open mouth with the resulting drag on the sides of the nose, and atrophy of the dilator muscles of the alae from prolonged disuse, are the chief factors in producing the condition.

Treatment. The first point is to remove the cause, namely, the nasal obstruction. The collapse of the alae, however, frequently of itself produces so much obstruction that free nasal respiration cannot be restored until this also has been overcome. The best treatment in my experience is a course of regular exercises designed to strengthen the wasted muscles. The patient should be instructed to expand the nostrils against resistance. For 5 to 10 minutes twice a day he should stand in front of a mirror and, lightly pressing the alae of the nose with the finger and thumb, dilate the nostrils to their fullest extent. This method often gives good results in recent and not too advanced cases. In old-standing cases complete atrophy of the dilator muscles may be found, and the patient may not have the slightest power of expanding his nostrils. Then other methods must be resorted to.

The treatment formerly recommended was to insert into the nostrils small circles of rubber drainage tube or similar dilators, to keep the nares permanently expanded.¹ I have frequently tried, but have been compelled to abandon, the method. The dilators are very uncomfortable to the patient, who soon gets tired of wearing them, and they produce no lasting benefit. Walsham² attempted to overcome the deformity by operative measures. He raised a strip of the mucous membrane from the anterior part of the septum, leaving it attached by its upper end; he then rolled up this strip so as to form a small tumour at the upper angle of the nostril, which mechanically prevented the collapse of the ala. Of this method

¹ Guye, *Münchener med. Wochenschr.*, 1898, xlv. p. 809; also Macdonald (*loc. cit.*).

² *Lancet*, 1901, i. p. 922.

I have no personal experience. Another method recently recommended by Menzel¹ is to inject paraffin wax into the alae and to hold them in position until the paraffin hardens. This method is apt to cause so much thickening of the alae that any good effect the stiffening might produce is undone, as indeed occurred in one of Menzel's two cases.²



FIG. 54A.—COLLAPSE OF THE ALAE NASI.



FIG. 54B.—THE SAME NOSE WITH WOOL PLUGS INSERTED INTO THE VESTIBULE.



FIG. 54C.—OPERATION FOR CORRECTING THE DEFORMITY.

In one extreme case I have performed a modification of Walsham's operation. The patient had long slit-like nostrils and completely flaccid alae nasi giving rise to almost complete nasal obstruction. The operation consisted essentially in turning up a piece of cartilage as well as mucous membrane from the septum, and stitching it across the top of the nostril at right angles to the septum so as to push the alae forcibly outwards. An L-shaped incision was made through the mucous membrane on one side of the nasal septum, and the mucous membrane detached from the cartilage. A small piece of mucous membrane at the top, and extending a little on to the outer wall, of the nostril was then cut away so

¹ Menzel, *Münchener med. Wochenschr.*, 1903, l. p. 778.

² See also Dundas Grant, *Journ. of Laryngol.*, 1904, xix. p. 202.

as to leave a bare surface to which the cartilaginous flap could become adherent. The knife was now passed completely through the septum, and a small quadrilateral piece of the septum, with the mucous membrane on the opposite side left intact, was cut. This flap was about half an inch long and an eighth of an inch broad. It was fixed to the roof and outer wall of the nostril with a single stitch. A similar piece was then turned up on the other side (see Fig. 54C). The operation was tedious, but the result was good. A similar result may often be obtained by teaching the patient to insert small round plugs of wool into the most upper and anterior part of the vestibule (see Fig. 54B).

EPISTAXIS.

Epistaxis is not only a common symptom of various diseases in the nose, but may occur under a large number of constitutional conditions. Usually of slight importance, it may be serious or even dangerous. It is never a disease *per se*, but always a symptom either of some local affection of the nose or of some constitutional disturbance.

Aetiology. Amongst the constitutional causes may be mentioned:—

1. Various disorders of the blood, such as the severer forms of anaemia, purpura, leucocythaemia, scurvy, haemophilia, etc.

2. Various chronic organic diseases giving rise to vascular congestion or high arterial tension with or without arterial degeneration. Amongst these may be mentioned cardiac affections, especially when there is engorgement of the right side of the heart and back pressure symptoms, chronic bronchitis and emphysema, chronic renal disease, and cirrhosis of the liver. In all these affections a serious amount of bleeding may occur. In some of them, especially those associated with gout or alcoholism, rhinitis sicca may be present (see local causes).

3. Certain fevers. Epistaxis is a common symptom in the early stages of typhoid fever, and occurs more rarely in scarlet fever, measles, and other fevers. It often occurs in whooping cough as a result of the vascular disturbance produced by the violent cough. Instances of epistaxis in acute rheumatism have been recorded by Sidney Phillips,¹ who saw 10 cases, and de Havilland Hall.² L. Shaw noted epistaxis 11 times in 174 cases.

4. Any cause of temporary increase in the blood pressure, such as may be produced by violent exercise or mental excitement. Coates³ records five cases all due to sudden high arterial tension brought on by overwork, fatigue, and exposure to cold. In three a cardiac valve gave way. Epistaxis is common both in boys and girls at about the age of puberty, and, in women subject to it, it is especially apt to occur at, or just before, the menstrual period.

¹ *Lancet*, 1902, i. p. 512.

² *Westminster Hosp. Reports*, 1893, viii. p. 1.

³ *Lancet*, 1901, i. p. 1133.

5. Venous engorgement of the head from pressure upon the veins in the neck, the result of tumours, etc.

6. Diminution of the surrounding atmospheric pressure, as in mountaineering and ballooning.

7. Chronic alcoholism. In this condition rhinitis sicca is probably present, and is the true exciting cause.

Finally Osler¹ has seen epistaxis associated with multiform angiomas of the skin occurring in seven members of one family.

In many of the above conditions the actual exciting cause of the bleeding is often some trivial trauma, such as violent blowing of the nose, sneezing, picking at the nose, etc.

Of **local causes** the most common is **rhinitis sicca**. In this affection the anterior part of the septum is liable to become excoriated or ulcerated. Dust from the inspired air mixed with dried mucus forms small tenacious crusts which adhere firmly to the ulcerated surface, and the detachment of these crusts gives rise to repeated epistaxis. Small dilated venules are frequently seen on the anterior part of the septum, and may readily bleed on being touched with a probe. Sometimes a small blood clot is seen blocking one of these vessels, indicating the spot from which the haemorrhage has occurred.

More rarely bleeding may take place from other vessels. Brown Kelly² records four cases of severe epistaxis from the ethmoidal veins. Occasionally the bleeding spot has been found on the inferior turbinate.

Amongst other local conditions which may give rise to epistaxis must be mentioned ulceration, whether due to syphilis, tubercle, or malignant disease, and many tumours, notably the bleeding polypus of the septum, malignant disease, whether ulcerated or not, fibroma, and more rarely adenoids. In all these cases profuse haemorrhage may occur. The presence of a foreign body or sequestrum is often accompanied by slight attacks of epistaxis, or more commonly by a blood-stained discharge. A sanguineous discharge is also met with in some of the more acute affections of the nose, such as fibrinous rhinitis and acute ulcerations.

Symptoms and Diagnosis. Epistaxis may be profuse, and rapidly produce faintness or collapse, but more often it takes the form of small repeated haemorrhages. The latter usually do no harm, but when frequently repeated, may lead to anaemia and general ill-health. Occasionally epistaxis exhibits a definite periodicity; it may recur regularly at yearly, half-yearly, or at more frequent intervals. In women it may precede or accompany the menstrual flow.

Apart from the cases with gross lesions, the bleeding point is almost invariably to be found on the anterior part of the nasal septum. This is the usual source of haemorrhage even when the primary cause is some constitutional disorder. Small excoriated or ulcerated spots may be seen in this

¹ *Journ. of Laryngol.*, 1902, xvii. p. 35.

² *Journ. of Laryngol.*, 1900, xv. p. 165.

region often traversed by enlarged venules (Fig. 55). These vessels may have small varicosities, or a tiny blood clot may be seen, the removal of which at once sets up the bleeding. In rare cases the whole of the mucous membrane on the anterior part of the septum, and even on the adjacent part of the floor of the nose, is red and velvety, and bleeds freely on the slightest touch.

It is usually easy to determine that the blood is coming from the nose. Occasionally, however, it runs backwards into the throat, and may give rise to a suspicion of haemoptysis when it is coughed up, or to haematemesis when vomited. If the patient be seen while the bleeding is going on, and the throat be examined, the source will be obvious.



FIG. 55.—ENLARGED VENULES ON ANTERIOR PART OF SEPTUM NASI.

Treatment. The treatment must be considered in relationship to the cause.

1. When epistaxis is *due to constitutional disorder*, the first question to be considered is the advisability, or otherwise, of arresting the bleeding. In certain conditions haemorrhage does good, and need not be stopped, unless excessive. Thus in elderly plethoric individuals it is possible that an attack of epistaxis may ward off a cerebral haemorrhage.¹ Again, in typhoid fever, epistaxis should not be interfered with unless excessive. In back pressure due to cardiac or chronic pulmonary disease, such as bronchitis or emphysema, haemorrhage is beneficial. When the bleeding is excessive, or when for other reasons it is desirable to arrest it, the ordinary household remedies should be adopted in the first instance. Cold should be applied to the nose and face, and to the back of the neck, and the feet should be placed in hot water. The patient should lie down quietly and suck ice. If this treatment fail, the nose should be examined, especially

¹ Kompe, *Archiv für Laryngol.*, 1899, ix. p. 181.

the septum, and local means employed, as described below. When this fails, or is impossible, the nose must be packed (see page 53). Subsequently treatment should be directed to the underlying cause. In some cases it may be necessary to adopt means to lower the high arterial tension.

2. When epistaxis is *due to severe local disease*, such as malignant ulceration, similar household remedies should be adopted in the first instance. If available, ice should be applied to the nose, and small pieces may even be inserted into the nasal fossae. If these remedies fail, and the bleeding is profuse, it becomes necessary to pack the nose. This should be carried out in the way about to be described, and it may be necessary to pack the post-nasal space as well as the anterior nares.

3. In the *ordinary form of epistaxis* in which the bleeding takes place from the anterior part of the septum, the best plan is to effect a radical cure by obliterating the bleeding vessels. If the haemorrhage be not very profuse, it is usually possible to arrest it temporarily by inserting into the nose a plug of cotton wool soaked in suprarenal extract and cocaine. When this has been done, the anterior part of the septum should be carefully examined, and any bleeding spot sealed with a touch of the red-hot cautery. If varicose vessels are seen, they should be divided in two or three places with the cautery, and thus obliterated. The after-treatment consists in the application of ointment or oil to the affected part, to prevent the formation of crusts and the renewal of the bleeding when they are detached. In this way complete healing usually takes place. If the cautery be not at hand, the bleeding may be arrested by packing the anterior nares. All that is necessary is to insert a fairly large plug of wool or gauze (moistened with oil to facilitate its removal) into the anterior nares, and to compress the nostrils with the fingers. This brings direct pressure to bear upon the bleeding spot. The ordinary household remedies above described may also be adopted. The plug should not be retained for more than 24 hours, but may be renewed if necessary. A simple plug of this kind is far preferable to applying wool soaked in turpentine, perchloride of iron, or other styptics, as is frequently recommended.

In the very severe cases in which the whole of the mucous membrane of the anterior part of the septum and the adjacent parts is thick, red, velvety, and tends to bleed upon the slightest pressure, more radical measures are necessary. A case of this kind has been described by Hunter Mackenzie, and I have seen one in the practice of my colleague, Mr. Parker. In the latter, profuse repeated haemorrhages had reduced a healthy man to breathless anaemia. Packing the nose with strips of gauze soaked in oil, and repeated applications of the cautery, failed to give relief. Under these circumstances, Parker adopted the plan described by Mackenzie of stripping off the mucous membrane from the entire bleeding area. One extensive operation failing, it had to be repeated, and a large piece of the cartilaginous septum was removed. This operation was successful. Neither

in this case, nor in Hunter Mackenzie's, could any underlying constitutional disorder be discovered.

The following papers may be consulted :

HUNTER MACKENZIE. *Lancet*, 1902, i. p. 1318.

PHILLIPS. *Lancet*, 1902, i. p. 512.

F. DE HAVILLAND HALL. *Westminster Hospital Reports*, 1893, viii. p. 1.

DONOGÁNY. (Local causes) *Archiv für Laryngol.*, 1899, ix. p. 30.

HEADACHE, PAIN AND TENDERNESS.

The association of headache with nasal troubles has been studied by Hack,¹ Bresgen,² Heymann,³ and others. For some time past I have investigated the subject, and have received valuable suggestions from Dr. Head and Mr. J. G. Turner. Affections of the nose may give rise to pains varying both in intensity and in site; sometimes they are described as headaches, sometimes as neuralgia. Patients frequently seek relief for headache alone, and having no symptom distinctly pointing to the nose, the nasal disorder which is the cause of the trouble is overlooked, and a diagnosis of nervous headache is made. Increased experience leads me more and more to the conviction that headache should never be ascribed to general causes until every source of local trouble has been excluded. This applies not only to headaches, but to the various other pains which are often described as facial neuralgia.

The pain from nasal affections may be of the most various kinds. It may be constant or exhibit more or less periodicity. The pain may be described as tearing or as a feeling of pressure on the head: it may be a heavy, dull, aching sensation, or sharp and stabbing in character. It may be limited to the frontal region or spread down into the nose, into the upper jaw and teeth, and even into the lower jaw. The pain may be described as situated behind the eyes or deep in the head, on the top of the head or at the back of the neck; it may be unilateral or bilateral. When it is very severe it is often associated with areas of skin tenderness. Bloch states that all forms and varieties of headache may occur, that there is no characteristic feature depending upon the site of the lesion, and that pain of a similar kind both in intensity and in site may be due to lesions in other organs. Grünwald states that true hemicrania may be due to a nasal affection. I have met with one case in which severe headache and neuralgia on the right side of the head and face were absolutely limited, according to the patient's statement, by a vertical line drawn down the centre of the face. As a last resource this patient had her nose examined as she had slight nasal obstruction. A very large spur on the right side of the septum was found. This was sawn off with

¹ *Berlin. klin. Woch.*, 1882, xxv. p. 379.

² *Münch. med. Woch.*, 1893, xl. p. 81.

³ *Deutsch. med. Zeitung*, 1893, xiv. p. 295.

complete relief: the patient over three years later remained free from pain. Sargent Snow¹ records 30 cases with pain of nasal origin, 14 of which had typical hemicrania. In the majority a spur on the septum, or enlargement of the middle turbinate was found. Nasal treatment benefited every case, 40-100 per cent. of improvement being obtained. Lermoyez² records a case of severe supraorbital neuralgia following the application of the cautery to the inferior turbinate. This body was hypertrophic, and its removal cured the patient. A nerve fibre was found in the scar left by the cautery. Meyjes³ records a case of supraorbital headache cured by the removal of a foreign body—a centipede—from the nose.

Neuralgic pains in the face are often due to diseases of the nose although there may be no other symptom pointing to this origin. I believe that in nearly every case of facial neuralgia some local cause exists, be it an affection of the teeth, of the upper jaw, or of the nose. When cocaine is applied to the interior of the nose, and especially to the anterior part of the septum, the incisor teeth and occasionally the canine and bicuspid become anaesthetised, and the pain of operations upon the nose is often referred to these teeth. It is not strange then that pain and tenderness referred to the gums and teeth of the upper and even of the lower jaw should sometimes be due to disease in the nose, or that pain in the nose should occasionally be due to disease of the teeth. Severe trigeminal neuralgia has been cured by treating the sinuses⁴ and also by removal of the middle turbinate.⁵ The well-known violent tic-douloureux is however a distinct affection and never depends upon disease of the nose.

Although it is impossible either to make any exact statement as to what forms of headache are due to nasal trouble, or to exclude disease of the nose as the cause of the pain from its particular character or site, the following varieties may be more or less definitely distinguished.

(1) Headache of a dull, aching character, occurring chiefly in the morning on waking from sleep, and wearing off during the day. This form of headache is common in children suffering from nasal obstruction. It is a direct result of the deficient oxygenation of the blood during sleep and the consequent disturbed rest, terrifying dreams, etc. (see page 70).

(2) Pain in the supraorbital region and down the side of the nose with superficial tenderness over the painful areas is usually due to enlargement of the anterior end of the middle turbinate (Fig. 56). The pain may be unilateral or bilateral and when intense may spread into other regions; it may be diffused over the head and radiate into both

¹ *Medical News*, 1897, lxxi. p. 42. ² *Archiv Internat. de Laryngol.*, 1901, xiv. p. 266.

³ *Journal of Laryngol.*, 1898, xiii. p. 543.

⁴ StClair Thomson, *Proc. Laryngol. Soc. of London*, January, 1898, and *Journ. of Laryngol.*, 1898, xiii. p. 139.

⁵ W. G. Spencer, *Journ. of Laryngol.*, 1898, xiii. p. 139.

upper and lower jaws. Pain in the supraorbital region is frequently ascribed to suppuration in the frontal sinus or is looked upon as a symptom of disease in the antrum or anterior ethmoidal cells. Strictly speaking I believe this is incorrect. It is indeed often associated with these affections and disappears when they are treated, but in such cases there will be found inflammatory swelling of the middle turbinate due to the irritation of the pus which constantly comes in contact with it. Pains



FIG. 56.—DIAGRAM OF PAIN AREAS IN NASAL DISEASE. 1, 1. Disease of middle turbinate. 2. Disease of frontal sinus. 3. Disease of antrum.

similar in all respects may occur in simple enlargement of the middle turbinate without any sinus trouble.

Cases of supraorbital pain, in which the frontal sinuses have been opened and found healthy are reported by de Santi,¹ Abercrombie,² Waggett,³ and others. Sometimes it is expressly mentioned that the middle turbinate was much enlarged, and that its removal alone sufficed to relieve the pain. Thus Stewart⁴ reports a case of frontal headache as due to disease in the frontal sinus, which was cured by removal of the middle turbinate. Hajek⁵ states that supraorbital headache indicates disease in the frontal sinus. He considers swelling of the nasal mucous membrane never causes

¹ *Proceed. Laryngol. Soc. of London*, 1902, p. 84, and *Journ. of Laryngol.*, 1902, xvii. p. 249.

² *Journ. of Laryngol.*, 1902, xvii. p. 348.

³ *Journ. of Laryngol.*, 1902, xvii. p. 214.

⁴ *Lancet*, 1898, ii. p. 1547.

⁵ *Wien. klin. Rundschau*, 1899, xxii.

headache except possibly when the tubercle of the septum is involved. Dundas Grant¹ reports three cases of frontal headache associated with diseases in different sinuses; all of these had enlargement of the middle turbinate. In another report,² he describes two cases of headache due to suppuration in the antrum and sphenoidal sinus; in both the middle turbinate was oedematous, and in one partial removal of this body relieved the pain. Mayo Collier³ relates two cases of trigeminal neuralgia due to disease of the middle turbinate, and cured by its removal.

The exact way in which the pain is produced is open to dispute. It is most probably the result of pressure, the swollen middle turbinate being nipped between the unyielding outer wall of the nose and the nasal septum. The pain may be periodic, depending upon collapse or swelling of the mucous membrane covering the bone. There is often a depression on the septum opposite the enlarged anterior end of the turbinate showing the occasional existence at any rate of considerable pressure.

(3) Headache or pain exhibiting more or less definite periodicity is very suggestive of suppuration in one of the accessory sinuses of the nose. The pain comes on gradually, increases in intensity as the affected cavity fills with pus, and then suddenly subsides as the pressure is relieved by the escape of the discharge into the nose. Severe periodic pain referred to the top of the head, or a dull, heavy feeling as of a weight pressing on the head, should excite suspicion of suppuration in the frontal sinus. Pain at the back of the head or back of the neck, or situated deep in the head behind the eyes and behind the nose, should excite suspicion of disease in the sphenoidal sinus or posterior ethmoidal region. Pain and tenderness over the malar bone, passing upwards to the outer angle of the eye, indicates affection of the maxillary antrum. The pain of ethmoidal disease is referred to the forehead, to the eyes, or deep behind the eyes, or to the top of the head.

The pain associated with these various affections will be more fully described later. It is sufficient again to emphasise the fact that headaches and neuralgias are constantly associated with, and due to, disease of the nose, although other symptoms of nasal disease may be absent, and there may be nothing in the patient's statements to draw attention to the true source of the trouble.

AFFECTIONS OF NEIGHBOURING ORGANS AND GENERAL HEALTH.

Of the Air Passages and Lungs. The intimate dependence of pharyngeal and laryngeal affections upon diseases of the nose is well known.⁴ Pharyngitis and laryngitis sicca are invariably due either to a

¹ *Journ. of Laryngol.*, 1897, xii. p. 665. ² *Journ. of Laryngol.*, 1899, xiv. p. 452.

³ *Lancet*, 1895, ii. pp. 91 and 529.

⁴ Dundas Grant, *Journ. of Laryngol.*, 1899, xiv. p. 552, relates many cases of laryngitis due to nasal disease.

similar dry condition of the nasal fossae, or to nasal obstruction and the consequent mouth breathing. Patients frequently come under treatment complaining of hoarseness, of discomfort in the throat, etc., which prove quite intractable until treatment is directed to the nose. The formation of foetid muco-purulent crusts in the trachea, a true tracheal ozaena, is well recognised as a result of nasal ozaena. Further, when from any cause the nose cannot properly fulfil its functions, there is an increased liability to all forms of disease of the lungs. Thus phthisis is undoubtedly predisposed to by ozaena; chronic bronchitis is commonly seen associated with chronic nasal diseases, especially those causing obstruction; even pneumonia has been ascribed to the spread of an acute catarrh downwards from the nose. Suppurative disease of the nose is a not improbable cause of certain cases of purulent bronchitis and bronchiectasis.¹ Purulent rhinitis and sinus suppurations often give rise to mild brief attacks of pneumonia.²

Of the Ear. The dependence of aural diseases upon affections of the nose is too well known to need any insistence. The ears are directly connected with the post-nasal space, and the vast majority of catarrhal affections of the middle ear are directly due to infection spreading from the nose and post-nasal space through the Eustachian tubes. Adenoids, acute nasal and post-nasal catarrh, and chronic nasal catarrhs, ozaena, etc., frequently give rise to catarrh and obstruction of the Eustachian tubes, and to acute middle ear catarrh, suppurative or non-suppurative. These attacks may be recurrent, and may end in chronic middle ear catarrh, or even in chronic suppuration. It also seems probable that tinnitus aurium may be solely due to disease in the nose. At any rate, cases of tinnitus, increased by nasal catarrh and subsiding as the catarrh passes off, or cured by the treatment of suppuration in an accessory sinus, are often recorded.³

Of the Eye. That affections of the eye should be common in nasal disease is not to be wondered at. The orbit is surrounded by the nasal cavities on three sides, and separated from them only by thin bony plates, which are occasionally imperfect. Both cavities are supplied in part by the same vessels and nerves, and their mucous membranes are directly connected through the nasal duct. The eyes may be affected as a result of vascular changes, of septic infection, or of reflex action starting in the nose. Direct extension of suppurative diseases of the nose and of the nasal accessory sinuses may take place into the orbit, and give rise to orbital cellulitis or abscess. Conjunctival affections, dacryo-stenosis and -cystitis may be due to direct spread of disease from the nose through the lachrymal duct. This mode of infection is most common in tubercular disease of the nose, but may occur occasionally in the various forms of

¹ F. de Havilland Hall, Lettsomian Lectures, *Trans. Med. Soc. of London*, 1897, xx. pp. 142-215; *Journal of Laryngol.*, 1897, xii. pp. 199-259, etc.

² Mackie, *Journal of Laryngol.*, 1904, xix. p. 505.

³ Tilley, *Lancet*, 1904, i. 1414.

chronic rhinitis. Lubliner¹ reports 94 cases of dacryo-cystitis mostly associated with hypertrophic or atrophic rhinitis, in five only was the nose healthy. Kubli found disease in the nose in 199 out of 210 cases of lachrymal disease.

In blepharitis and conjunctivitis infection may result from direct extension through the lachrymal duct, or may be conveyed by the fingers. Trachoma has been ascribed to nasal disease by Ziem, but my own experience of a large number of cases does not confirm this. Oedema of the upper eyelid may be due to vascular changes, as the result of nasal obstruction, instances of which have occurred in my own practice. Disease of the optic nerve and of the optic chiasma may result from suppuration in the accessory sinuses extending into the cerebral cavity. Optic neuritis and atrophy may also result from direct extension of disease into the orbit. Ulcers of the cornea, iritis, and even cataract and glaucoma, have been ascribed to nasal disease (Ziem).

Disorders of accommodation, such as asthenopia, are common in nasal obstruction, especially when due to ethmoidal disease. Squint, internal and external, has also been ascribed to nasal affections; blepharospasm to synechiae, and convergent squint to adenoids. As reflex neuroses arising from the nose may be mentioned neuralgia of the eyeball, photophobia, amblyopia, lachrymation and epiphora, and scotoma. Schmiegelow, in 63 cases of sinus empyemata, found that 6 had epiphora, 1 conjunctivitis, 2 ciliary neuralgia and orbital pain, 1 squint, 5 dislocation of the eyeball, 3 orbital cellulitis, 2 amaurosis, 1 scotoma and asthenopia (see also Chap. XV.). For further information on this subject the following works may be consulted:

- CASTEX. (Hemianopia) *Internat. Centralb. für Laryngol.*, 1898, xiv. p. 72.
 HIRSCHMANN. *Internat. Centralb. für Laryngol.*, 1898, xiv. p. 389.
 RAYNER BATTEN. (Myopia in adenoids) *Lancet*, 1895, ii. p. 96.
 DONALD GUNN. (Ophth. Society Reports) *Ophthalmic Review*, 1900, xix. p. 31.
 STC. THOMSON. (Muscae Volitantes) *Journ. of Laryngol.*, 1896, x. p. 139, and *Proc. Laryngol. Soc.*, London, 1895-96, iii. p. 48.
 HALÁSZ. (Conjunctivitis, Empyema of antrum) *Archiv für Laryngol.*, 1903, xv. p. 241.
 SEIFERT. *Münch. med. Woch.*, 1898, xlv. p. 923.
 STIEL. *Münch. med. Woch.*, 1898, xlv. p. 125.
 LUBLINER. *Therap. Monatshefte*, 1896, x. p. 646 (*Ref. Journ. of Laryngol.*, 1897, xii. p. 217).
 ZIEM. *Journal of Laryngol.*, 1901, xvi. p. 416.
 ZIEM. *Monatschr. für Ohrenheilk.*, 1893, xxvii. pp. 231, 261.
 KUHN. Ueber die entzündlichen Erkrankungen der Stirnhöhlen u. ihrer Folgezustände, Wiesbaden, 1895.
 SCHMIEGELOW. *Archiv für Laryngol.*, 1904, xv. p. 267.
 ONODI. *Archiv für Laryngol.*, 1905, xvii. p. 260.

¹ *Therap. Monatshefte*, 1896, x. p. 646; *Ref. Journal of Laryng.*, 1897, xii. p. 217.

Of the Cerebral Cavity. The cerebral cavity and its contents may be infected by direct spread of septic diseases from the nose. The thin partitions between the cavities may be perforated, and suppuration in the nasal cavity may give rise to meningitis, or to cerebral abscess. These affections are most common in connection with suppuration in the accessory sinuses, and will be again referred to (see Chap. XV.). Septic cerebral affections may also arise from infection passing along the lymphatics or veins of the nose, which freely communicate with those of the brain.

The close connection between the brain and the nose, probably due to the connections between their lymphatic and vascular systems, is also shown by the influence of some nasal diseases upon the general mental condition. Inability to fix the attention, general depression, loss of mental capacity, are all common in obstructive nasal diseases.

Of the Face, Palate, etc. Septic affections of the nose may also attack the neighbouring parts as the result of direct extension through the walls of the cavities. Thus, as the result of antral suppuration, an abscess may form in the cheek, or in the hard palate; frontal sinus disease may give rise to an abscess on the forehead, or to diffuse osteo-myelitis of the skull; orbital abscess or cellulitis may result from disease in the antrum, ethmoidal or frontal sinuses. It is possible that antral suppuration may lead to decay of the teeth, but the reverse order of events is more common (see also Chap. XV.).

Of the General Health. The results of nasal obstruction on the general health have already been fully described (see page 71). When nasal disease is associated with purulent or mucopurulent discharge, symptoms of septic poisoning are generally present. These symptoms may be partly due to direct absorption through the nasal lymphatics and partly to swallowing the discharge. Patients often complain of dyspepsia, of loss of appetite, and of a tendency to be sick in the morning; they are often bilious, or suffer from intermittent diarrhoea.¹ Local signs of sepsis are seen in the enlarged glands in the neck. General signs, partly at any rate attributable to this cause, are wasting, loss of energy, and mental apathy associated with a sallow spotty complexion. Very rarely acute septicaemia or pyaemia may result from septic diseases of the nose. I have twice seen septic thrombosis of the cavernous sinus follow furuncle of the vestibule. Lenzman² relates several cases of general septic infection, in one of which there was thrombosis of the cavernous sinus.

ANOSMIA.

The loss of the sense of smell is usually combined with loss of taste for flavours. This sense is of considerable importance to the general

¹ See also Tilley, *Journal of Laryngol.*, 1903, xviii. p. 584.

² *Munch. med. Woch.*, 1898, xlv. p. 797.

welfare of the individual. It guards against the inhalation of noxious gases and prevents the ingestion of unwholesome food. Besides this it adds much to the pleasures of life and increases the appetite for, and the enjoyment of, food.

Anosmia may be divided into three etiological groups. (1) Obstructive anosmia due to any form of nasal obstruction which prevents the olfactory particles in the air reaching the olfactory mucous membrane. (2) Essential anosmia due to some affection of the olfactory mucous membrane or of the peripheral nerve endings. (3) Central anosmia due to disease or injury to the brain or olfactory nerve.

Obstructive Anosmia. Among the causes of obstructive anosmia may be mentioned all forms of nasal obstruction such as alar collapse, deflections and thickenings of the nasal septum, inflammatory swelling of the mucous membrane—especially of the middle turbinate, tumours of the nose and especially polypi, foreign bodies, rhinoliths, adhesions, etc. It is also possible that when the nasal passages are extremely wide as in ozaena the stream of air may pass along the inferior meatus and not reach the olfactory region.

Treatment. The treatment of this form of anosmia consists in the removal of the cause. If this can be effected recovery may take place although the sense of smell has been completely lost for years. Morell Mackenzie makes the statement that if the sense of smell has been in abeyance for two years the prognosis is extremely unfavourable. I have, however, had several cases of nasal polypi under my care in which anosmia has been present 6, 8 and even 10 years and yet the power of smell has returned almost completely after the eradication of the polypi. A few similar examples of recovery after long absence of smell are recorded by others.

Essential Anosmia, or affections of the olfactory region itself. Amongst the causes of essential anosmia are various toxic poisons. Thus, the application of cocaine solution to the olfactory region will quickly cause temporary loss of smell; solutions of morphine and atropine are said to act in a similar way. It is stated that excessive use of tobacco may produce anosmia, but this is not proved (Onodi). The anosmia which occurs in ozaena is probably due to atrophy of the olfactory mucous membrane; it is usually incurable, persisting after all discharge has ceased. Extensive ethmoidal disease in nasal polypus may also lead to permanent anosmia. Loss of smell has also been ascribed to the use of carbolic acid in nasal douches.¹ Personally I have not found this.

Influenza is another frequent cause. During the acute attack the anosmia may be due to mechanical interference with the air stream as the result of swelling of the nasal mucous membrane. But it frequently lasts weeks or even months after all indications of nasal trouble have subsided. In these cases it is probably due to some alteration in the

¹ M^cBride, *Journ. of Laryngol.*, 1903, xviii, p. 326.

olfactory nerve endings; the exact lesion is unknown. This form of anosmia may be partial or intermittent; the patient may be able to perceive some odours better than others, or the sense of smell for certain odours alone may be lost. Again the patient may be able to smell fairly well during some part of the day, but the olfactory power is easily tired.

Anosmia is also met with during many fevers and in poisoning by morphia, lead, mercury, etc. Syphilis also has been considered as an exciting cause. The most probable lesion if really due to the syphilis would be gumma of the nerve or of the olfactory bulb.

Treatment. When due to influenza the most hopeful treatment is the internal administration of strychnine and quinine. Arsenic has also been strongly recommended. If the anosmia is intermittent or partial, complete recovery will ensue probably after a few weeks or months. In complete anosmia the prognosis is very doubtful, but even in such cases recovery is not uncommon. When syphilis is suspected appropriate remedies must be adopted. If a toxic poison or if excessive use of tobacco be probable, the cause must be removed and strychnine may be prescribed.

Central Anosmia. The olfactory nerve may be affected by injuries to the head such as fractures of the base of the skull, by tumours including gummata, and by certain central nervous diseases such as tabes, syringomyelia, etc. In a few cases anosmia has been ascribed to hysteria, or to neurasthenia. Loss of smell on the same side as the paralysis is said to be common in hemiplegia.

Treatment. The treatment consists in the removal of the cause as far as possible. If this can be done the prognosis is good. Neurasthenic and hysterical cases must be treated by appropriate general measures.

HYPEROSMIA.

Hyperosmia is a very rare affection. It is met with in hysteria and in a few other nervous conditions. It may be produced by strychnine poison, and often occurs intermittently in the early stages of pregnancy. It must be remembered that some people are much more sensitive to smells than others and are especially susceptible to certain odours. Thus various smells may turn some people quite faint, or make them sick, etc. The prognosis and treatment is dependent upon the cause, and needs no discussion.

PAROSMIA.

Parosmia may be defined as the condition in which some or every odour excites an abnormal sensation in the patient, generally of an unpleasant character: this perverted sensation often long survives the cause which excited it. Parosmia must be distinguished from the hallucinations of smell which occur in the insane, when odour may be complained of without any definite objective cause. Perversions of smell

differ from perversions of other senses in that they are almost always of an unpleasant, even of a most vile character. The patient complains that everything smells of burnt substances, of decaying things, etc. The chief causes are hysteria, neurasthenia, influenza, the psychoses of pregnancy, and some central nervous affections such as tabes, epilepsy, etc. Before a diagnosis of parosmia is made the greatest care must be exercised to exclude any local hidden cause for the smell either in the nose, mouth, accessory sinuses, throat, stomach, lungs, etc. Patients with antral suppuration may seek relief entirely for the evil smell in the nose, and be quite unconscious of or deny the presence of any unusual nasal discharge or of any other symptom whatever. The same applies to affections of the other sinuses. Again syphilitic ulceration or necrosis in the posterior part of the nose may give rise to parosmia, and may be easily overlooked. In doubtful cases the mouth should be examined for carious teeth, the throat for decomposing particles in the follicles of the tonsils, etc. Disorders of the stomach and diseases of the lungs should be looked for. In one case under my care the most intense parosmia was due to bronchiectasis, although the patient never complained of chest trouble. The greatest care must be taken to exclude all these causes before a diagnosis of true parosmia is made.

The treatment is similar to that of true or essential anosmia; the prognosis is as a rule good.

References.

- ONODI. Journ. of Laryngol., 1900, xv. p. 579.
ONODI. Archiv für Laryngol., 1903, xv. p. 125.
REUTER. Archiv für Laryngol., 1899, ix. p. 147 and p. 343.
ZWAARDEMAKER. Archiv für Laryngol., 1896, iv. p. 55.

CHAPTER VI.

FOREIGN BODIES. RHINOLITHS.

FOREIGN bodies in the nose are most frequent in children, and are introduced by them in play or because of some local irritation. They are rarely met with in adults, except in lunatics or as the result of accident. Children will put all sorts of things into their own or each other's noses: the most common are beads, boot buttons, bits of paper, string, india-rubber, pencils, small stones; vegetable substances, such as peas and beans: almost anything of a convenient size may be met with. In adults the most common foreign body is a pledget of cotton wool, which has been introduced by a surgeon and forgotten.

It must also be remembered that foreign bodies may enter the nose through the post-nasal space during swallowing, when there is either deficient action or paralysis of the palatal muscles, or when some deformity, such as perforation of the palate exists. I have one patient who repeatedly suffers from a foreign body in the nose: without any apparent cause a piece of food enters during swallowing, and is often retained until severe symptoms, such as suppuration, result. In the act of vomiting it is by no means uncommon for some of the stomach contents to enter the nose, more especially during intoxication. Again, medical literature teems with records of foreign bodies, such as bullets, fragments of knife blades, and pieces of stick, etc., which have been forcibly thrust into the nose through external wounds and have been broken off. Amongst rarer instances it may be mentioned that styles inserted in the lachrymal duct occasionally find their way into the nose. The style usually passes backwards, and lies in the inferior meatus high up in the concavity of the inferior turbinate, its head remaining in the lower end of the duct. In this position the foreign body cannot be seen by rhinoscopy, and in the majority of cases cannot even be touched with a probe. Its presence may be demonstrated by the Röntgen rays (see Fig. 57).

Aberrant teeth may be found in the nose—a very rare occurrence. Seifert¹ has collected a series of cases and others have been recorded by

¹ *Rev. de Laryngol.*, 1895, xv. p. 1021.

Daal,¹ Jurasz,² and Hecht.³ Their occurrence may be accidental or due to faulty development. Sometimes they are displaced normal teeth, usually the canine, or they may be supernumerary. They are found on the floor of the nasal fossa just behind the vestibule and are usually attached to the mucous membrane only. They are easily recognisable by their colour and consistence and may also be demonstrated by the X-rays.

Foreign bodies belonging to the animal kingdom are rarely seen in this country. Bond⁴ has recorded the case of a woman from whose nose two larvae were removed. They were identified as the larvae of *Piophilæ Casei*. Such cases are apparently much more common in America and elsewhere. Thus Miller⁵ removed 76 bluebottle larvae, and Folkes⁶ removed 131 worms each half an inch long from the nostril of a negro.

Foreign bodies in the post-nasal space are very rare. I have removed a curtain ring which was partially lying in this space and giving rise to symptoms of adenoids. Other cases are recorded by Parker⁷ and Patterson.⁷ Foreign bodies may also gain entrance to the accessory sinuses, either by being forcibly thrust in through the walls, for example, bullets, pieces of knives, etc., or a piece of straw or other light substance may be inhaled into the nose and enter the cavity through its ostium. A tube inserted by a surgeon may also slip up and lodge in the antrum.

Symptoms. The symptoms vary greatly, depending upon whether the foreign body is round and smooth, or rough and angular, or consists of vegetable or other absorbent material. The most common and characteristic symptom is a unilateral purulent, foetid, blood-stained nasal discharge, which produces excoriation of the upper lip. The presence of this symptom in children should always excite suspicion of a foreign body in the nose. When the foreign body is round, smooth and non-absorbent, all symptoms may be absent, unless it be large enough to cause nasal obstruction. A rough and angular body always sets up more or less acute rhinitis, but the most severe symptoms are those resulting from the presence of an absorbent substance, which readily becomes soaked in decomposing discharges, or of a vegetable body, such as a bean or pea, which may swell up and actually sprout in the nose. In the latter cases besides profuse discharge there may be severe pains in the nose, headache, facial

¹ *Archiv für Laryngol.*, 1895, ii. p. 301.

² *Archiv für Laryngol.*, 1904, xvi. p. 325.

³ *Archiv für Laryngol.*, 1905, xvii. p. 167.

⁴ *Proc. Laryng. Soc. of London*, 1895-96, iii. p. 66, and *Journ. of Laryng.*, 1896, x. p. 236.

⁵ *Medical Fortnightly*, 1897, x. p. 282.

⁶ *Medical Record*, 1897, li. p. 677.

⁷ *Proc. Laryng. Society of London*, 1899, vi. p. 61, and *Journal of Laryngology*, 1899, xiv. p. 252.

neuralgia, and general constitutional disturbance with febrile symptoms. The nose and neighbouring part of the cheek may be acutely red, swollen,

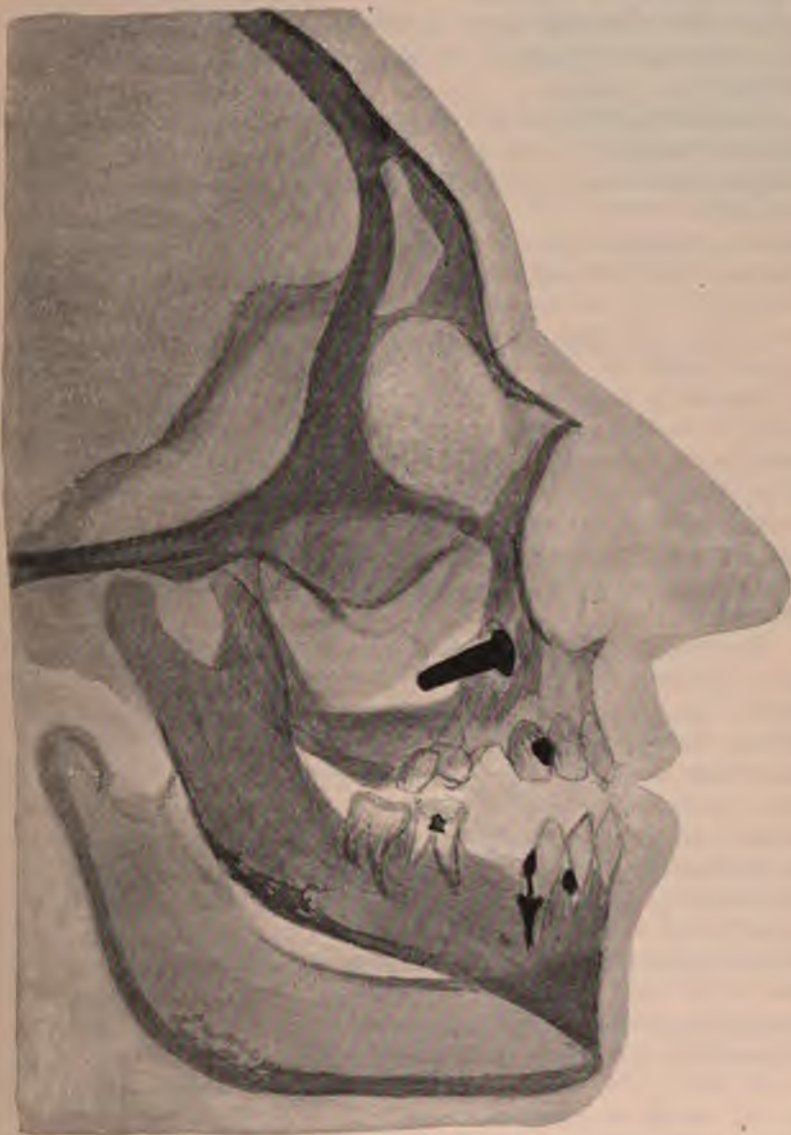


FIG. 57.—CANNULA PARTLY IN INFERIOR MEATUS, PARTLY IN ANTRUM, AND INVISIBLE BY RHINOSCOPY. From an X-ray photograph.

and tender. Reflex symptoms and ear and eye troubles may also follow, as in other acute diseases of the nose.

Diagnosis. The diagnosis can usually be readily made from the

presence of the above symptoms, but should be confirmed by inspection, by examination with the probe, or, when the foreign body is of metallic origin, by means of the X-rays. The latter are especially useful in cases, such as that of the style above mentioned, in which the foreign body lies in a position where it cannot be seen by rhinoscopy or reached with the probe.

In children, instead of making an attempt to clean away the discharge so as to see into the nose, or to use the probe, it is better to introduce a strabismus hook, or a probe with its point bent to a right angle, through the middle meatus above and beyond the supposed foreign body and then by drawing it forward to make the diagnosis and to remove the foreign body at the same time. It is a great advantage to make the diagnosis by this method as a child easily becomes frightened by the use of a probe. He often resists vigorously, and the foreign body is apt to be pushed further in. The affection which gives rise to the most difficulty in diagnosis in children is the unilateral form of fibrinous rhinitis. By using the hook as above described a piece of membrane, or a foreign body, as the case may be, will be removed. In adults the affection has to be distinguished from the various forms of ulceration, especially from tertiary syphilis, from necrosis and sequestra, from sinus suppuration and from rhinitis caseosa. If cocaine be applied and the nose cleaned, the diagnosis by inspection, aided by the probe usually presents no difficulties.

Treatment. The best method is to extract the foreign body with a hook: in the majority of cases an ordinary strabismus hook or a tonsil probe (Fig 58) answers the purpose admirably. Sometimes, however, when a smooth, rounded, foreign body is present, the hook tends to slip off, and for these bodies a hook with a looped end should be used (Fig. 58). As a rule, if the child is not very nervous and has not been previously frightened, no anaesthetic need be given.

Under good illumination the hook is passed with the greatest gentleness, and without touching the mucous membrane, through the anterior nares, up into and through the middle meatus of the nose, until it is well behind the foreign body, which is almost invariably situated in the anterior third of the inferior meatus. The hook is now lowered into the inferior meatus and drawn gently forward. When it comes in contact with the foreign body it may give rise to pain, and the child's head will be rapidly drawn back. This, however, only hastens the extraction. When the child is very nervous or frightened, when previous attempts at extraction have failed, or when the foreign body is tightly wedged in, a general anaesthetic should be given and extraction carried out in the same way.

The use of the forceps is not nearly so convenient. To grasp a foreign body accurately a view of it must be obtained, and even then, if smooth or rounded, it is extremely apt to slip from the grasp of the forceps, or to be pushed further in by attempts to grasp it. In difficult

cases it is often recommended to push the foreign body through into the throat. There is, however, no necessity for this, as extraction can always be accomplished with the hook.

The very rare cases in which a large foreign body has been forcibly thrust into the nose and is perhaps partially embedded in its walls come under another category. Different methods of treatment altogether are required, and some preliminary operation such as Rouge's may be necessary. In a case of a style occurring in my own practice, I opened the nasal fossa through the canine fossa and antrum as in the radical operation upon that cavity.

Other methods may be briefly mentioned. It has been recommended to apply a solution of cocaine and suprarenal extract to the nose until



FIG. 58.—HOOK WITH SIMPLE PROBE END AND WITH LOOPED END, FOR REMOVING FOREIGN BODIES FROM THE NOSE.

the nasal mucous membrane is completely anaesthetic and collapsed, and then the patient may be able to expel the foreign body by forcibly blowing the nose. If much inflammation be present, however, cocaine will not act well, and this method is therefore generally ineffective.

Again, Politzer's method of inflation has been recommended. The nozzle of a Politzer's bag is introduced into the healthy nostril, and the soft palate being raised by directing the patient either to blow out the cheeks or to swallow, air is forcibly driven in, and the foreign body driven out from behind forwards. On a similar principle it has been recommended to inject fluids down the healthy nostril whilst the patient's mouth is wide open and thus to wash out the foreign body. Both these methods are dangerous, as they are extremely likely to force purulent material or fluid into the Eustachian tubes and middle ear, and thus to set up acute otitis. Moreover, they will not dislodge a foreign body which is at all large or fixed.

(For a full discussion of the whole subject see *Proc. Laryngol. Society of London*, 1896, iii. pp. 58-60 and 73-80, reported in *Journ. of Laryngol.*, 1896, x. p. 310, and in current literature.)

RHINOLITHS.

Rhinoliths, or stony concretions, consist of inorganic material deposited from the nasal secretions. There is usually a nucleus consisting of a small foreign body or of a particle of dried blood or mucus. Any of the foreign bodies above enumerated may form the centre of a rhinolith. A

nucleus is probably always present: the cases in which a thorough histological examination has been made without finding one are extremely rare.¹ When no history of a foreign body is obtainable, it may be found that the nucleus is a particle of food which has entered the nose during vomiting (Hopmann)² or that it is a piece of necrosed bone. Chemically, rhinoliths have been found to consist chiefly of calcium phosphate (50 to 60 per cent.), calcium carbonate (10 to 20 per cent.), phosphate and carbonate of magnesia in smaller and variable proportions, 15 to 20 per cent. of organic constituents, and 4 to 10 per cent. of water. A specimen of Cheate's analysed by Jackson yielded equal parts of calcium phosphate and calcium carbonate.³ Histologically they may be found to contain large masses of bacteria and leptothrix; an active rôle has been ascribed to these (Gerber), but they probably play only a passive part.⁴

Rhinoliths may be met with at all ages and in all situations. They generally occupy the inferior meatus, but occasionally are found in the middle. If large, they may occupy both meatus, may even perforate the septum and lie in both nostrils, or extend from the anterior to the posterior nares. The presence of two rhinoliths is very rare. They usually form roundish or oval masses, with irregular outlines and sharp angles, and vary in colour from a greyish brown to a dark green. The colour is probably due to blood pigment. Most of them are of earthy consistence, but occasionally they are very hard.

Symptoms. The symptoms of a rhinolith are exactly similar to those of a foreign body in the nose, and need not be again repeated. They are, however, characterised by even greater variations. Thus a rhinolith may remain twenty, or even forty, years in the nose without giving rise to any marked symptom. On the other hand it may set up the most acute inflammation, not only of the nose, but of the neighbouring parts, such as the palate, pharynx, etc. On examination the body may be seen free in the nose, without any secretion or surrounding inflammation, or it may be entirely hidden by purulent bloody discharge, or imbedded in exuberant granulations. In rare cases, when long retained, a rhinolith may attain huge dimensions; it may fill or even distend the whole nasal fossa, cause atrophy of the turbinates, and perforation of the septum. It may be visible by both anterior and posterior rhinoscopy.

Treatment. The treatment is exactly similar to that of a foreign body in the nose, but it may be necessary before attempting removal to reduce the size of the rhinolith, either by cutting it with a pair of strong forceps or scissors, or by crushing it. This is in most cases easily accomplished,

¹ See, however, Halász, *Archiv für Laryngol.*, 1904, xvi. p. 539.

² *Journ. of Laryngol.*, 1900, xv. p. 208.

³ Cheate, *Journ. of Laryngol.*, 1902, xvii. p. 358.

⁴ See Lantin, *Archiv für Laryngol.*, 1896, iv. p. 137.

and the extraction then gives rise to no difficulty. For very large rhinoliths Rouge's operation has been recommended. It can very rarely be necessary: but I have once advised it in the case of a densely hard incrustated sequestrum.

Bibliography.

SEIFERT. Heymann's Handbuch der Laryngol. u. Rhinol., Wien, 1899, Bd. iii. p. 550.

CHAPTER VII.

AFFECTIONS OF THE SEPTUM.

DEFORMITIES. SYNECHIAE. CONGENITAL ATRESIA OF POSTERIOR CHOANAE. ABSCESS. PERFORATIONS.

DEFORMITIES OF THE SEPTUM.

DEFORMITIES of the septum are extremely common, numerous statistics showing that more or less asymmetry occurs in about 80 per cent. of European skulls. Morell Mackenzie found deviation of the bony septum in 77 per cent. of over 2000 skulls which he examined in the Royal College of Surgeons. Löwenberg found asymmetry of the septum in 86 per cent., Heymann in 96 per cent., Stier in 69 per cent, and Zuckerkandl in 53 per cent. Mayo Collier found the septum normal in only 10 per cent. of over 1000 skulls. Most of these statistics apply to the bony septum: some irregularity of the anterior cartilaginous portion is almost constant. Abnormalities of the septum are much less common in the lower races, Mackenzie and Zuckerkandl found the septum normal in 80 per cent. Deflections of the septum are more common in the leptoprosopic than in the chamaeprosopic type of head.

Pathological Conditions. Deformities of the septum may be classified into deviations or deflections and thickenings or outgrowths, but these two varieties are often met with in association.

Deflections may be C- or S-shaped, the former being the more common. The bending may be most marked in the vertical or in the horizontal direction. When the septum is of normal thickness throughout, one nostril may be narrowed and the other more roomy than normal. Very commonly, however, the deviation is complicated by extensive or irregular thickening of the septum, and thus, whilst one nostril is extremely narrow, the other is of normal width, or even obstructed. The thickening is mainly due to enlargement of the cartilage or bone, but may be increased by swelling or hypertrophy of the overlying mucous membrane. Another form of deflection of the septum is the so-called dislocation of the triangular cartilage. In this variety the anterior or lower edge of the triangular cartilage is deflected from the middle line, so as to produce obstruction

in the vestibule of the nostril. This can be most easily observed by simply raising the tip of the nose with the finger, without the use of the speculum, when the lower edge of the cartilage will be seen to project sharply under the mucous membrane and more or less to obstruct the lumen of the nostril.

Outgrowths of the septum may either take the form of spines, spurs, crests, ridges, etc., or of diffuse irregular thickenings. They may run in a vertical or in a horizontal direction. They are very common and often quite unimportant, but may give rise to nasal obstruction and other symptoms. A very common ridge is one which commences on the anterior and lower part of the septum, just behind the triangular cartilage, and gradually increases in thickness as it runs upwards and backwards towards the sphenoid bone. This ridge is an abnormal thickening of the processus sphenoidalis of the triangular cartilage, and is seen in about 33 per cent. of skulls.

Double or divided septum has also been described, but is an extremely rare deformity the aetiology of which is doubtful. I have seen a dermoid cyst on the lower part of the bridge of the nose, producing deformity of the triangular cartilage and partially dividing the septum into two portions. The cause of this condition is therefore probably some congenital anomaly.

Aetiology. Apparently deviations of the septum may be congenital, for Anton saw nine instances in 56 infantile skulls, and other less important similar statistics have been published. Zuckerkandl, however, states that septal deviations very rarely occur before the age of seven, and Dr. Keith informs me that he has never seen a congenital deflection. As a matter of clinical experience, all forms of septal irregularity are very rare in children. I have never seen a true deviation under the age of six, but have, in a few instances, observed small projections or spurs in younger patients.

The great majority of deflections of the septum are probably due to **irregular development**, that is, there is a disproportion between the growth of the septum and the growth of the nose, the former growing comparatively too fast or the latter too slowly. It is quite obvious that if a septum be C- or S-shaped it is too long for the vertical diameter of the nose. I believe, as the result of repeated examinations in connection with this point, that deviations form most commonly during the period of the second dentition, when, as already described, rapid development of the upper jaw and nose is proceeding (p. 10). This development may possibly be interfered with by many causes, but especially by nasal obstruction with the consequent mouth-breathing. In many cases of adenoids, as is well known, the palate becomes high and narrow, and the whole upper jaw is undersized, the floor of the nasal cavity is raised, the vertical diameter of the nose is diminished, and consequently the septum has not its normal room in which to develop. Therefore, should the septum attain its full dimensions under these conditions, it must be distorted. Again, it is possible, although

unlikely, that the septum may grow too quickly or develop unequally on the two sides: this may result from some inherited anomaly, or possibly from rickets. The deformity of the upper jaw which is due to nasal obstruction in early life, and which produces the high-arched palate and the consequent diminished height of the nasal cavity, is in my opinion the commonest cause of deflection of the septum (see Fig. 47).

Another commonly ascribed cause is **trauma**. This may account for many cases of deflection of the cartilaginous portion of the septum, but it is extremely difficult to see how a blow can fracture the vomer, or the perpendicular plate of the ethmoid, protected as they are by the solid bony bridge of the nose and by the firm arch of the nasal bones; and it is more difficult still to understand how this could occur without marked external deformity. Moreover, it would be sad to think that trauma was more frequent in civilized than in uncivilized races, and as above stated septal deformities are about eight times more frequent in the former than in the latter. These considerations lead me to suspect that trauma does not account for so large a number of deflections of the bony septum as was formerly supposed.¹ It is possible, however, that a deviation of the cartilage resulting from trauma may affect the growth of the bony septum, and thus produce deviation. The thickening which may occur around a deviation is probably due to inflammation. Blows and other injuries to the nose are apparently often followed by a slowly progressive hyperplastic periostitis, and thus the thickening may be looked upon as a late result of trauma. Krieg considered that of a series of 130 cases upon which he operated 18 were due to trauma and 112 to elongation of the septum.

Some other causes may be briefly mentioned. It has been stated that excessive swelling or hypertrophy of the inferior turbinate may push the septum over to the opposite side. This is doubtful; it seems more natural to suppose that the hypertrophy of the turbinate is compensatory, the result of the excessive roominess of the nostril. Hypertrophy of the inferior turbinate is indeed common in an abnormally wide nostril, but it is rarely so excessive as to be in contact with the septum. A cyst of the middle turbinate may undoubtedly produce deflection of the septum, and the same thing may occur from the pressure of tumours, nasal polypi, etc. Septal irregularities arising from these causes have been called pathological deviations.

Deflections of the septum have also been ascribed to the habits of sleeping constantly upon the same side and of blowing the nose with the same hand. Both these methods of causation are purely hypothetical, and with regard to the latter it may be remarked that deflected septum is said to be as common amongst people who do not use handkerchiefs as amongst those who do.

¹ *Brit. Med. Journ.*, 1890, ii. pp. 617-620. The speakers at the meeting of the British Medical Association apparently regarded all deflections as traumatic.

Dislocation of the triangular cartilage is usually the result of trauma, such as falls on the nose, or blows; the cartilage being the most exposed part of the nose, and being yielding and unsupported, is naturally very liable to displacement.

Thickenings and Outgrowths when situated on the anterior third of the septum, are probably most often the results of trauma, the septum having been bent or fractured, and abnormal thickening having occurred around the site of union. Sometimes also a slowly progressive periostitis and perichondritis follows an injury to the nose, and may result in a somewhat diffuse thickening of the septum. In both cases more or less external deformity of the nose may be expected. The most common outgrowth, that occurring along the site of the processus sphenoidalis, is obviously a developmental anomaly, and is due to excessive enlargement of this process, being met with in some 33 per cent. of skulls (Fig. 1). It is possible that other cartilaginous growths on the septum are hypertrophies of the cartilages of the organ of Jacobson. The periosteum and perichondrium covering the framework of the septum are intimately blended with the mucous membrane, and it is probable that many slight causes may set up periostitis, especially the hyperplastic form. Thus severe or protracted nasal catarrhs may possibly be added to the causes of septal deformities.

Symptoms. The majority of septal deformities give rise to no symptoms at all. The patient, with even a large ridge or spur, or less rarely with a considerable deflection, may be quite unconscious of anything amiss with the nose. In marked cases there may be complete unilateral or bilateral nasal obstruction with its consequences, mouth breathing, catarrh of the upper air passages, dry throat, sleeplessness, headache and various nervous sequelae. There is often associated deformity of the external nose. In less marked cases the patient may be conscious of more or less nasal obstruction, especially when the mucous membrane is swollen by acute catarrh. Occasionally a deformed septum may be the apparent exciting cause of some of the reflex nasal neuroses, and it is possible that even a small spur in contact with an inferior turbinate in a hyper-sensitive patient may set up well-marked symptoms. In a large majority of cases, however, the symptoms resulting from a slightly deflected septum, or a small spur, crest or ridge, are insignificant.

Diagnosis. This presents no difficulties, but the following points should be attended to. The nose should be thoroughly anaesthetised with cocaine and suprarenal extract, and the antero-posterior extent of the deflection should be determined, if necessary with the probe, as also the thickness of the septum at the deflected spot. Again, the nose should be examined both by anterior and posterior rhinoscopy, and any associated hypertrophy of the inferior turbinates, or the presence of adenoids, should be noted. The greatest caution must be exercised before concluding that a small septal deformity is the exciting cause of nasal or of reflex symptoms.

No definite rules can be laid down on this point; only a complete consideration of all the patient's symptoms can lead to a decision in any given case as to whether an operation is likely to be of benefit (see Chap. XIV.).

Treatment. Septal deformities require treatment only when they give rise to symptoms which can be definitely or rationally ascribed to their presence, or when they interfere with the carrying out of other treatment: *e.g.* when they hinder access to the accessory sinuses or prevent the passage of a Eustachian catheter. When there is only slight nasal obstruction which is chiefly due to an associated chronic rhinitis with catarrhal swelling of the mucous membrane, it is often sufficient to treat the catarrh with lotions, or to reduce the swelling of the mucous membrane with the cautery (see p. 140). In such cases, which are by no means uncommon, no operation on the septum is required. In young children small spurs or ridges may safely be removed, but it is inadvisable to perform any of the larger operations for deflections of the septum for fear that the operation should be followed by arrest of development and subsequent sinking in of the bridge of the nose. In other cases one or other of the operative methods about to be described may be performed. It must be borne in mind that it is not always necessary or desirable entirely to correct the deformity; all that is required for the welfare of the patient is to remove the hindrance to free nasal respiration. A very large number of operative methods have been described. Some consist in the removal of a piece of the septum so as to reduce its thickness; some in straightening the septum with or without first cutting or fracturing it; others in straightening after removal of a piece; and others in making perforations through the septum. The operation to be chosen depends upon whether a simple deflection or a thickening is present, and also upon whether the anterior cartilaginous part of the septum or the bony posterior part is affected. I shall first describe the methods upon which I have always mainly relied, and subsequently give a brief account of the more important of other methods.

Of Ridges, Spurs, Crests, etc. These, if small, and not containing bone, may be easily removed with the spoke-shave (Fig. 70). The operation is extremely simple and quickly performed. The crest or spur and the parts around should be thoroughly anaesthetised and rendered bloodless by the application of cocaine and suprarenal extract. A general anaesthetic is rarely necessary. With a narrow-bladed knife an incision is made over the most prominent part of the deflection, and with a small elevator or blunt dissector the mucous membrane with the perichondrium is raised from the part to be removed. The spoke-shave is now passed beyond the spur, and then, by sharply dragging it forwards, the whole of the projecting part can be removed without damage to the mucous membrane. The operation may also be performed by simply cutting off the ridge with a firm probe-pointed knife, having first detached the mucous membrane

as above described. The cut in the mucous membrane closes rapidly and no sutures are required.

Very often in removing septal spurs no attempt is made to save the overlying mucous membrane, but the operation just described probably gives the best results. Its performance takes a little longer, but this is



FIG. 59.—GOLDSMITH'S NASAL SAW.

of no importance when local anaesthesia is sufficient. It saves the dry patch on the septum with crust formation, so commonly seen for some weeks after an operation or other wound has healed by granulation. It is easily performed when the spur is in the anterior part of the nose, when the preservation of the mucous membrane is most important. When a wound is situated further back in the nose dryness and crusting do not so



FIG. 60.—BOSWORTH'S NASAL SAW.

readily occur, and the operation may be simplified and shortened by simply removing the spur with the mucous membrane covering it. This is also advisable in patients of a very nervous disposition who require a general anaesthetic such as nitrous oxide, which does not allow sufficient time for the longer procedure. The ultimate results show little difference.

The **after treatment** consists in using an ordinary nasal wash such as a solution of boracic acid two or three times daily, and in applying an oily solution such as the Pigment. Hydrarg. Nit. with a brush or by means of a nebulizer. No packing or splint is required.

Of large Bony Projections. When there is a large thickening of the bony septum causing nasal obstruction, it is best to remove the projecting part with a saw. For this purpose a fine, stiff saw is required, Goldsmith's (Fig. 59) is perhaps the best, Bosworth's (Fig. 60), though much used, is too flexible. If the deflection is not too close to the floor of the nose, it is better to use a saw with the cutting blade upwards, but if this cannot be done, one with the cutting edge downwards must be selected. The blade of the saw having been inserted under the part to be removed, the direction in which the cut has to be made must be ascertained, and then, working rapidly and lightly, the bone is sawn through. The piece often remains adherent to the mucous membrane, in which case it may be grasped with forceps and clipped off with scissors. Many operators recommend the previous detachment of the mucous membrane so as to preserve it. This adds considerably to the difficulties and to the duration of the operation, without any great counter-balancing advantage. The loss of a small piece of mucous membrane far back in the nose does not seem to cause any particular harm.

The operation is always painful, and for most patients a general anaesthetic is necessary. In addition it is advisable to apply a solution of cocaine and suprarenal extract to the field of operation. Care must be taken that none of the cocaine be swallowed; otherwise the depressing effects of this drug, added to those of the general anaesthetic, may give rise to dangerous symptoms. On the other hand the local anaesthesia permits of less deep general anaesthesia. The great advantages of this application are that the mucous membrane is rendered bloodless and shrunk so that a better view of the spur is obtained, and the field of operation is less likely to become obscured by bleeding. The after-treatment is that just described. Bosworth, who perfected this method, reported a series of 166 operations, all of which were successful.

Instead of using the saw, some operators recommend the use of a chisel or of an electric saw¹ or trephine. These have no particular advantages, but the choice of instrument may well be left to individual preference.

These methods are sufficient for all cases of simple outgrowths, and if enough is removed the results are excellent. The operation is practically free from danger, the bleeding is usually insignificant and there are no unpleasant after effects. Healing occurs in about a fortnight, but there may be a tendency for crusts to collect on the site of the operation for some weeks or months. This can be prevented by applying an oily solution as above described. Other methods, such as the application of the electric cautery or of electrolysis, need not be described. They require many sittings, may give rise to severe reaction and more destruction than is desired, and may cause sloughing or perforation of the septum, whilst

¹ M. Schmidt, *Archiv für Laryngol.*, 1896, v. p. 14, strongly recommends the electric saw.

they present no advantages over the more simple and rapid cutting methods. Ballenger recommends electrolysis for small growths only, and emphasizes its difficulty. He applies a current of 10-27 milliampères for some minutes at each sitting.

Of Dislocated Triangular Cartilage. The so-called dislocation of the triangular cartilage, in which the anterior end of the cartilaginous septum projects into, and partly occludes one nostril, is best dealt with by a partial excision. The tip of the nose is pressed back with the operator's left thumb, an incision is made over the most prominent part of the projection with a sharp-pointed, narrow-bladed knife, the mucous membrane with the perichondrium is turned back, the cartilage is protruded through the incision and as much as is required sliced off with a knife or with scissors. If necessary, a single suture may be inserted to close the opening in the mucous membrane. This little operation is best performed under local anaesthesia. The pain is so slight that it can be easily tolerated by the most sensitive patient, but, if preferred, nitrous oxide anaesthesia may be used. The after-treatment consists in bathing the part frequently with a mild antiseptic solution, such as boracic acid, and in smearing it with a weak antiseptic ointment to protect it from dust and scabbing. If enough cartilage has been removed, an excellent result is obtained. No special retention apparatus is necessary.

Of Simple Deflection without Thickening. These cases are much more difficult to remedy. All the so-called bloodless methods, such as the application of hand pressure, or of splints and bandages externally, are useless. forcible compression with instruments, such as Jurasz's or Walsham's forceps or Delstanche's nasal clamps, is painful, and may give rise to sloughing, gangrene, or perforation of the septum. Moreover, these methods are inefficient when used alone: it is obviously impossible to force a curved septum back into the middle line unless it be fractured or a portion of it be removed, for the vertical dimensions of the septum are greater than those of the nose.

Gleason's Operation. The operation that I, personally, have found most convenient and successful in these cases is Gleason's. Under nitrous oxide, or other general anaesthetic, a saw is passed into the nose under the deflection, and first an inward, then an upward, cut is made as if for the removal of the entire deflected part. The blade of the saw soon divides the septum and enters the opposite nostril; the cut is continued vertically upwards in the plane of the septum until the deflected part is detached except for about one-quarter or one-fifth of its circumference at its upper part. The semi-detached piece hangs like a valve over the perforation, attached only along its upper edge, as by a hinge. The finger is forced down the obstructed nostril; the hanging piece of the septum is pushed through the perforation, when its edges will catch on the margins of the opening and prevent its return. The nose should be lightly packed with strips of gauze; it is better to pack both nostrils,

otherwise the septum may be pushed too far over, and a deflection on the opposite side may be produced. On an average the packing, changed daily or on alternate days, is continued for a week. Instead of strips of gauze, rubber splints such as Lake's may be used, but they are more uncomfortable and more difficult to keep accurately in position. The same objection applies to celluloid and metal splints. By this operation not only is the obstructed nostril freed, but the septum is often brought so accurately into the middle line that the previous existence of a deflection



FIG. 61.—GLEASON'S OPERATION FOR DEFLECTED SEPTUM. *A* shows the saw cutting the flap, and *B* the flap pushed through the aperture to the opposite side. In each case the upper of the two figures is the view (diagrammatic) from the side, the lower the view from the front.

would never be suspected, and there is little if any risk of a permanent perforation.

The operation is applicable for all cases of simple deflection without thickening of the septum, when the nose is fairly wide, and when there is no hypertrophy of the inferior or middle turbinate. If the inferior or middle turbinate in the wide nostril be hypertrophied, obviously this must first be removed or reduced in size.

Of Deflections in Narrowed Noses. When the deflection is associated with marked narrowing of the nasal fossae, the following method gives good results. The most prominent part, the apex so to speak, of the deflection, is completely cut away with the saw, giving rise to a small elongated, oval, or rounded perforation of the septum. Now, by means of the finger passed down the obstructed side, or, if more force be required, by means of special forceps, such as Adams' or by Delstanche's clamps, the septum is forcibly straightened. To do this it may be necessary to

fracture it. When a very small perforation has been made, the cut edges may be brought almost into contact, and possibly may even unite. Watson,¹ who recommends this method of removing an elliptical or wedge-shaped piece of the deflected septum, afterwards reduces the deformity and retains the parts in position with a strong pin. The pin is passed from the concave side, through the septum just in front of the deflection, over the convexity, and thence back through the septum into the concave side. It thus straightens and fixes the deflected part.

When great difficulty exists in straightening the septum, further incisions may be made round the perforation with special instruments, such as Asch's cutting forceps or with a knife or chisel. After the septum has been straightened the nose must be carefully packed, preferably with strips of gauze, to keep the parts in position. The gauze packing must be changed daily, or as often as is necessary, and the septum retained *in situ* for ten to fourteen days, after which there will be no further tendency to recurrence of the deviation. The necessity for thorough reduction of the deformity and for the most careful after-treatment must be insisted upon, as otherwise cases treated in this way are extremely apt to relapse.

Of Complicated Deflections. When a deflection of the septum is complicated by marked thickening over the most prominent part—a very common condition—treatment must be modified accordingly. In the first place, if removal of the thickened ridge alone will allow free nasal respiration, this is all that is necessary to be done. When the deflection is great, the removal of the ridge alone may be insufficient, and then the whole of the ridge should be boldly sawn off together with the apex of the deflection, so as to make an opening into the opposite nostril: the septum may subsequently be straightened as above described.

A convenient method of operating is to pass the blade of the saw below the deflected part and to cut inwards and slightly upwards until the opposite nostril is entered. The saw is now removed and inserted above the deflected part, and a second cut made downwards and inwards to meet the first. In this way a wedge or elliptical piece of the septum may easily be removed.

The operation usually leaves a perforation of the septum, but this is of little consequence. The patient will probably remain unconscious of it unless he is told. Healing takes place rapidly, there is little tendency to crust formation, and no special after-treatment is required. Packing the nose or the insertion of splints is usually unnecessary.

There seems at the present day to be great prejudice against the formation of a perforation of the septum. This in my opinion is quite unjustified. Some of the best results I have seen were obtained by perforating the septum. The rapidity of the method, the certainty of the

¹ Watson, *Journ. of Laryngol.*, 1896, xii. p. 8.

result, and the avoidance of the necessity for any after-treatment, render it far superior to the long complicated operations which aim at securing a mathematically perfect septum.

Krieg-Bönningshaus Operation. This method, introduced by Krieg in 1886 and revived by Bönningshaus in 1900, is generally known as the *Fenster-resection*. It consists in removing the whole of the bone or cartilage of the deflected part of the septum together with the mucous membrane covering it on the convex side.

The operation may be performed under local or general anaesthesia. In either case supra-renal gland extract must be freely applied locally: by rendering the tissues bloodless it greatly assists the operator and shortens the operation. An L-shaped incision is made on the convex side of the septum, the horizontal limb extending below and the vertical limb in front of the deflected part. The incision is carefully deepened through the cartilage, care being taken not to injure the mucous membrane on the concave side; a periosteum detacher or blunt dissector is passed through the cut in the cartilage and the mucous membrane carefully separated from the concavity of the deflection without tearing it. This is the most difficult part of the operation. When it has been accomplished, the cartilage and bone, together with the over-lying mucous membrane on the convex side of the septum, are cut away with knives, chisels, or punch forceps. The resection must be continued until the whole of the deflected part has been removed. The mucous membrane on the concave side of the septum alone is left to form the new septum.

This is a very thorough operation, but its performance occupies a considerable time. Krieg, who has operated on 130 cases, states that the operation requires 30-60 minutes under local anaesthesia. More time is required if a general anaesthetic is given, and Krieg's earlier cases took much longer. The operation leaves a large raw surface on the convex side, which requires 3-5 weeks to heal over, and for weeks or months afterwards has a great tendency to collect dry mucous crusts. This may be combated by painting the parts with oil, such as the *Pig. Hydrarg. Nit.* Krieg states that the results in his 130 cases were nearly all good; in some a perforation was made. I have performed the operation a few times; the results have been good, but I prefer the more rapid method of perforation. My colleague, Mr. Hunter Tod,¹ has employed it in 30-40 cases, and apparently prefers it to all other methods.

Submucous Resection. Apparently many surgeons have endeavoured to correct a deflected septum without sacrificing any mucous membrane. A very thorough operation of this kind has recently been elaborated by Killian and Freer. It is strongly recommended by Hajek, Menzel, Weil and others. It consists essentially of complete submucous resection of the whole thickness of the bone or cartilage of the deflected part of the

¹ *Journal of Laryngology*, 1904, xix. p. 303; and *Proc. of the Laryngol. Soc. of London*, 1904, xi. p. 144.

septum without removing any mucous membrane. An L- or V-shaped incision is made through the mucous membrane, on the convex side of the septum if possible, but if the deflection is large or situated far back in the nose, on the concave side. The flap of muco-periosteum, thus marked out, is separated from the underlying cartilage or bone by means of a blunt dissector. The incision is now deepened through the cartilage or bone, a blunt dissector or elevator is passed through the opening, and

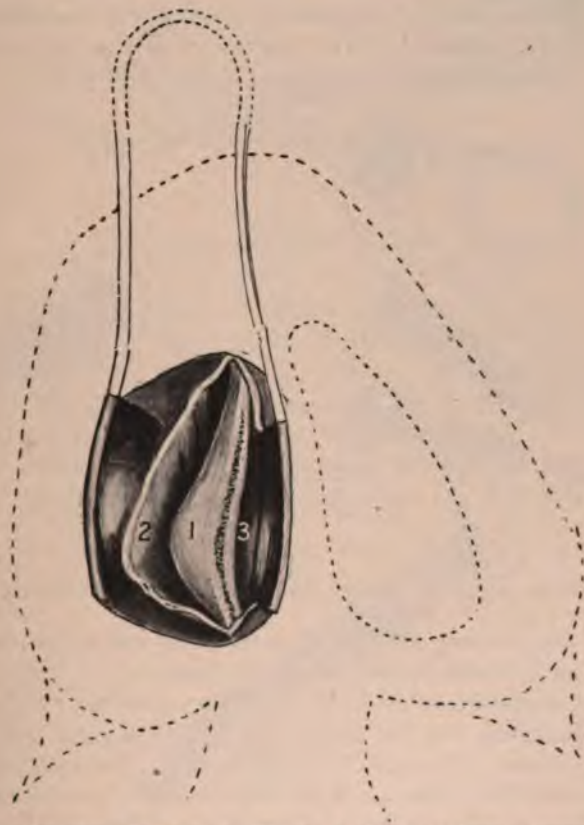


FIG. 62.—SUBMUCOUS RESECTION OF SEPTUM. 1. Mucous membrane on convex side. 2. Cartilaginous deflection. 3. Mucous membrane on concave side.

the mucous membrane on the opposite side carefully detached without perforating it. The whole of the cartilaginous and bony framework of the deflected part of the septum is thus isolated: it is removed piecemea with gouges, chisels, knives, or cutting forceps. This having been done, the muco-periosteal flap is allowed to fall back into position, and may be attached by one or two sutures.

No special after-treatment is necessary, and if the operation be thoroughly performed, a perfectly straight septum, without a perforation,

results. Thus the method has many advantages, but it has also disadvantages. It is extremely tedious and difficult to carry out without injuring the mucous membrane so severely as to cause sloughing and consequently a permanent perforation. Bleeding soon obscures the view, even if supra-renal extract is applied, endless sponging is necessary, and the operation in many cases requires an hour to two hours or more of general anaesthesia. I have employed it in a few cases of very marked diffuse thickening of the anterior part of the septum resulting from trauma. In these cases anaesthesia with cocaine and supra-renal extract alone is sufficient, and the operation is nearly bloodless. The septum in this region consists solely



FIG. 63.—MOURE'S OPERATION. The dotted lines show the two incisions.

of cartilage, and is easily and rapidly pared down with knives, or cut away with punch forceps such as Grünwald's or Woakes'.

The great advantages of both the preceding operations are the simplicity of the after-treatment and the absence of all necessity for splints or other retention apparatus. The great disadvantages are the difficulties in performing them and the time—an hour or more—that is required.

Many other methods have been described. They consist in making star-shaped, parallel, or oval incisions through the septum in various directions, with knives, chisels, or special cutting forceps, followed by forcible straightening, with or without special efforts to preserve the periosteum and mucous membrane.

Asch's operation, first described in 1889, is frequently employed at the present time, and has the great merit of being easily and rapidly performed, especially when the deflection is not too great and is limited to the cartilaginous portion of the septum. With special cutting forceps a crucial incision is made through the most prominent part of the deflection. The four triangular flaps are then pressed back into the median line, and

retained in position by splints or packing. Asch recommends a special tube splint which he retains in position on an average for four weeks. The great point in the operation is to fracture completely the bases of the cartilaginous flaps so as to overcome the resiliency of the cartilage and the tendency to recurrence of the deflection.

Rethi performs an operation similar in principle. He makes star-shaped incisions through the septum with knife or chisel, operating from the



FIG. 64.—MOURE'S SHEARS FOR SEPTAL DEFLECTIONS.

convex side if the deflection is anterior and not too marked, and from the concave side if the deflection be situated far back.

Roe advises submucous incisions through the deflected part of the septum and lays stress upon the necessity of thoroughly fracturing the cartilage at its junction with the bony septum.

Moure's operation. Moure first removes any spur or thickening of the septum and resects the triangular cartilage when required. He then makes



FIG. 65.—MOURE'S MALLEABLE SPLINT.

two more or less parallel incisions through the whole thickness of the septum. One is carried along the floor of the nose below the deflected part and the other parallel to the bridge of the nose, just above the deflection. The partially detached bridge of septum is forced back into the median line and retained by a properly adjusted malleable splint (Fig. 65). Moure retains his splint 7-8 days. This operation may especially be recommended when the external nose is deflected. A saw cut is then made along the floor of the nose and the septum completely detached from the palatal process of the superior maxilla. Its attachment to the vomer may now be fractured, and then the whole nose, as well as

the septum, may be easily straightened. Careful after-treatment is required to retain the nose in position. The operation is quick and not severe. There may be pain for the first 48 hours. Pegler has reported very favourably on this method, and Mayo Collier has effected great improvement in the shape of the nose itself by a practically identical procedure.

Finally, it has been pointed out that it is often easier to overcome the nasal obstruction by removing pieces from the outer wall of the nose so as to make an airway past the obstruction, than to operate successfully upon the septum. When the obstruction is low down inferior turbinectomy has been recommended; when it is high up removal of the middle turbinate. These operations may certainly sometimes have the advantage of being easy to carry out and may overcome the nasal stenosis, but it is bad surgery to remove large pieces of healthy and eminently useful normal structures, such as the turbinates, instead of dealing with the septum, solely because the operation is easier.

References.

- MAYO COLLIER (and discussion). *Journ. of Laryngol.*, 1896, x. p. 117; 1903, xviii. p. 24.
 Brit. Med. Assoc. Meeting, Birmingham in 1890. *Brit. Med. Journal*, 1890, ii. p. 617.
 HARTMANN and PETERSEN. *Berlin. klin. Woch.*, 1883, xx. pp. 329, 782.
 KRIEG. *Berlin. klin. Woch.*, 1889, xxvi. pp. 699, 717.
 ASCH. *New York Med. Journ.*, 1890, lii. p. 675; and *Proceedings 12th Annual Meeting Amer. Laryngological Assoc.*, 1890, p. 76.
 BÖNNINGHAUS. *Archiv für Laryngol.*, 1899, ix. p. 269.
 BALLENGER. (Electrolysis) *Journ. Amer. Med. Assoc.*, 1896, xxvi. p. 58.
 BOSWORTH. *Medical Record*, New York, 1887, xxxi. p. 115.
 KANTHACK. *Proc. Laryngol. Soc. Lond.*, 1894-95, ii. p. 47.
 BAUMGARTEN. *Monatschr. für Ohrenheilk.*, 1898, xxxii. p. 404.
 FLATAU. *Wiener klin. Rundsch.*, 1899, 40.
 HAAG. *Archiv für Laryngol.*, 1899, ix. p. 1.
 BOSWORTH, ASCH, ROE and GLEASON. *Laryngoscope*, 1899, vi. pp. 337, 340, 344, 352.
 MOURE. *Journ. of Laryngol.*, 1901, xvi. p. 163.
 HAJEK. *Archiv für Laryngol.*, 1903, xv. p. 45.
 MENZEL. *Archiv für Laryngol.*, 1903, xv. p. 48.
 VICTOR LANGE. *Heymann's Handbuch der Laryngol. u. Rhinol.*, vol. iii. Wien, 1899, pp. 440-506.
 OTTO FREER. *Journ. Amer. Med. Assoc.*, 1902, xxxviii. p. 636; and 1903 xli. p. 1391; and *Annals of Otol., Rhinol. and Laryngol.*, 1905, June.
 MOURE. *Journal of Laryngology*, 1901, xvi. p. 163.
 SUCKSTORFF. *Archiv für Laryngol.*, 1904, xvi. p. 362.
 WEIL. *Archiv für Laryngol.*, 1904, xv. p. 578.
 KRIEG. *Archiv für Laryngol.*, 1900, x. p. 477.
 ZARNIKO. *Archiv für Laryngol.*, 1903, xv. p. 248.
 KILLIAN. *Archiv für Laryngol.*, 1904, xvi. p. 362.

SYNECHIAE, OR ADHESIONS BETWEEN THE SEPTUM AND OUTER WALL OF THE NOSE.

Causation. Adhesions most frequently occur between the inferior turbinate and the septum, but are more rarely seen in the upper part of the vestibule and in the middle meatus. They may result from any condition in which the septum and the outer wall of the nose are simultaneously denuded of epithelium. Thus, they may follow various forms of trauma; ulceration of the nose, such as occurs in syphilis, acquired or congenital; or acute inflammatory affections, such as fibrinous rhinitis or nasal diphtheria. One of the most common causes is the unskilful application of the electric cautery. The possibility of an adhesion emphasises the necessity of avoiding injury to the septum when operating upon the inferior turbinate, and *vice versa*. Similarly curettement of the upper part of the nose, as for nasal polypi, may result in adhesions between the middle turbinate and upper part of the septum. A web-like band across the nose, at the junction of the vestibule and mucous membrane proper, is often congenital, but may result from trauma or from syphilis, lupus, etc.

Symptoms. Synechiae may consist of long narrow bands, or of broad firm adhesions between two closely adjacent structures. The former usually cause no symptoms, or at the most a slight dragging sensation and a feeling of, rather than actual, nasal obstruction. The latter are most common between the inferior turbinate and the septum, and generally give rise to more or less obstruction to nasal breathing, especially to expiration. The adhesion has a tendency to entangle the secretions, which thus collect in the inferior meatus and produce considerable discomfort. Synechiae may also hinder the inspection of the posterior or upper parts of the nose, and may prevent approach to the accessory sinuses or hinder the passage of the Eustachian catheter. The worst adhesions are those which result from imperfect operations on the septum, in which a surface has been bared of epithelium, and the opposing area of the turbinate injured, without the removal of a sufficient amount to leave a free passage. In these cases a broad firm band of union is apt to occur.

Treatment. In recent cases. If a case be seen when an adhesion is in process of formation, an attempt may be made to prevent its occurrence. Having thoroughly anaesthetised the nose, a probe may be gently inserted between the raw adhering surfaces, and then a narrow strip of gauze soaked in oil is introduced. Many other substances have been recommended in place of gauze, such as thin strips of rubber, metal or ivory plates, and celluloid films. These are non-absorbent and easily changed, but more uncomfortable than gauze, which in my experience is the best material to use. The gauze packing must be changed daily, and the nose irrigated with a mild antiseptic solution. In these cases, however, the mucous membrane is often inflamed, and any attempt to

keep the parts separate causes so much local irritation and swelling that it soon becomes intolerable. Occasionally a good result is obtained, but more often, after weeks of treatment, the raw surfaces refuse to heal until all packing or splints have been removed. If, therefore, after a reasonable time failure seems certain, it is better to stop the treatment and allow the adhesion to form.¹

In Chronic Cases. Synechiae may require to be removed if they produce symptoms, such as nasal obstruction, expiratory or inspiratory, or a sense of dragging pain in the nose, or if they prevent the carrying out of other necessary operations, such as the passage of the Eustachian catheter, or if they are a source of reflex symptoms. When the synechiae are small and elongated, they may be simply divided, as there is no tendency for re-adhesion to take place. After the application of cocaine the adhesion may be cut through with the galvano-cautery, or with a hook-shaped knife, which is passed behind the adhesion and forcibly drawn forwards. In more extensive adhesions, it is better to use the galvano-cautery, as the charred surfaces have little tendency to reunite at any rate for a few days. The only after-treatment necessary is to see the patient every second or third day for a fortnight, and, after applying cocaine, to pass a probe between the raw surfaces and see that the adhesion does not re-form. An ordinary cleansing lotion or better still an oily application such as the Pigment. Hydrarg. Nit. may be ordered.

If an extensive adhesion be present, such as may form between a large spur on the septum and the inferior turbinate, the best plan is to saw through the spur, completely detaching it from the septum, and then to remove with the spoke-shave the spur, the adhesion, and a considerable piece of the adjoining turbinate. In this way a large gap is left between the raw surfaces, and healing will take place without any tendency to re-formation of the adhesion. No special after-treatment is required, beyond the use of an ordinary nasal wash, but the patient should be seen every second or third day until healing is complete, so that any exuberant granulations can be snipped off or cauterised.

Reference.

Discussion Laryngological Society of London, March, 1899. Reported in Journ. of Laryng., 1899, xiv. p. 249, etc.

CONGENITAL ATRESIA OF THE POSTERIOR CHOANAE.

Complete atresia of the nostrils is extremely rare: only one case has been shown and four others mentioned in discussion in the Laryngological Society of London during the last twelve years. The occlusion may be

¹Vide *Proceedings Laryngological Society of London*, 1904, March.

unilateral or bilateral, membranous or bony. It is usually situated at or close to the posterior choana, and is congenital, although a membranous obstruction may possibly be acquired.

Haag gives details of 44 cases which he has collected from medical literature. Of these 20 were bilateral and in all but one the obstruction was bony; 24 were unilateral. It is interesting to note that of the 20* cases which were bilateral, in only one was the upper jaw normally developed; all the others and 75 per cent. of the unilateral cases had a high narrow-arched palate. The deformity was equal on both sides even when the nasal obstruction was unilateral. The nasal passages were often otherwise well-developed. These observations go far to confirm the views that have already been expressed upon the aetiology of the high palate, and upon its association with nasal obstruction (see p. 63).

Diagnosis. The symptoms are those of unilateral or bilateral nasal obstruction. On examination with the post-nasal mirror or with the finger the complete obstruction of the posterior choana on one or both sides is readily made out. Cocaine and supra-renal extract should be applied to the anterior nares and examination made from the front with the aid of the probe. In this way the nature of the obstruction, whether fibrous or bony, can be recognised.

Treatment. Under general anaesthesia and with the finger passed up into the post-nasal space to serve as a guide and to prevent injury to other parts, an opening is broken through the occlusion with a burr or gouge. Subsequently as much of the obstructing tissues as possible is broken up or cut away with forceps. A thin rubber tube should be passed through the opening to counteract the tendency to contraction. Apparently this operation has usually been successful. Should there be a tendency to contraction in spite of these precautions, Symonds' suggestion of the removal of the posterior part of the septum seems worthy of consideration. It can be easily accomplished with strong post-nasal forceps such as Loewenberg's.¹

Reference.

IWANOFF. *Archiv für Laryngol.*, 1904, xvi. p. 332.

ABSCCESS OF THE SEPTUM.

Acute abscess of the nasal septum is a rare affection, being met with not oftener than once in 1500 to 2000 of the patients attending a special clinique in London. It is most common in children, and usually results from trauma. Thus, of 12 cases seen in the last seven years, amongst approximately 17,000 patients, all were due to trauma, and only two occurred in adults.

¹ A case of this kind, in a girl aged 16, has just come under my care. The palate was markedly deformed. The obstruction was bilateral and bony. It was broken down with burrs and the posterior end of the septum was removed with Loewenberg's forceps.

The **symptoms** are very characteristic. On examination the nasal fossae are found to be blocked by a symmetrical, bright red, tender, fluctuating swelling, situated on the anterior part of the septum. The end of the nose is frequently hot, red, swollen, and tender. The usual history is that the child has received a severe blow or has fallen heavily on the nose, and that this was followed by bleeding and nasal obstruction. These symptoms soon subsided, but a few days later the nose became swollen, painful, and completely obstructed. In other cases the development has been more insidious, and the subjective symptoms by no means well marked.

Septal abscesses due to other causes, for example, to erysipelas, typhoid fever,¹ small pox, tubercle, influenza, and sinus suppuration,² have been described. Kuttner³ has recorded three cases, and Wroblewski⁴ has recorded five as idiopathic. Killian⁵ has recorded a case due to a dental abscess, and states that two other similar cases are known to him.

The abscess usually contains pyogenic staphylococci. Carrière reports a case in which living larvae were found: the abscesses due to typhoid fever, tubercle, etc., would probably have the specific organisms present.

Pathology. The history indicates that in all probability a haematoma of the septum has followed the injury to the nose, and that pyogenic organisms have subsequently gained admission through an abrasion in the mucous membrane. This hypothesis is often demonstrated by finding large pieces of degenerated blood-clot in the pus on evacuating the abscess. Sometimes the blood is extensively effused beneath the perichondrium, stripping it up, and the abscess is apt to result in necrosis of the cartilage. This is especially liable to occur when the cartilage has been extensively broken up, and then a perforation or deformity of the septum and falling in of the bridge of the nose may occur as a late result. The deformity of the nose is probably due as much to the original trauma as to the abscess, though little may be noticeable till some time after the injury. Then a steadily progressive sinking in of the bridge of the nose may ensue and may continue to increase for years, partly perhaps as a result of slow contraction of the fibrous tissue, and partly because the injury has stopped the further natural growths of the parts.⁶

Diagnosis. The diagnosis is simple, depending upon the evidences of acute inflammation and the presence of a bilateral fluid swelling on the anterior part of the septum. The abscess is invariably symmetrical,

¹ Wroblewski, *Archiv f. Laryngol.*, 1895, ii. 287.

² Hunter Tod, *Journ. of Laryngol.*, 1903, xviii. p. 35. Wertheim, *Archiv für Laryngol.*, 1900, xi. p. 209, and StC. Thomson, *Journ. of Laryngol.*, 1901, xvi. p. 38.

³ *Archiv für Laryngol.*, 1895, ii. p. 72. ⁴ *Archiv für Laryngol.*, 1895, ii. p. 287.

⁵ *Münch. med. Woch.*, 1900, xlvii. p. 155.

⁶ Vide Spencer, *Proc. Laryngol. Soc. Lond.*, 1900-01, viii. p. 3.

probably because the original injury causes a fracture of the cartilage of the septum. Gumma most usually occurs in adults, attacks the bony septum and rapidly ulcerates; it is often unilateral, and the evidences of acute inflammation are less marked.

Treatment. This consists in immediate evacuation of the pus by free incision on both sides of the septum. This is usually successful, but the patient should be seen every second or third day at least, and the incisions kept open by gently inserting a probe. Should the pus reaccumulate, it is



FIG. 66.—ABSCESS OF SEPTUM NASI.

better to snip out a small piece of the abscess wall on one or both sides. This is easy, effectual, and does no harm. On the other hand, it is difficult to secure drainage by packing the cavity or by fixing in a drainage tube, except by passing the latter quite through the septum. This latter method is almost certain to produce a permanent perforation, and should therefore be avoided.

As a general rule complete healing takes place in from 10–14 days without any deformity. Sometimes, however, when there has been severe trauma, when evacuation of the pus has been too long delayed, or when a virulent infection is present, necrosis of cartilage may occur, may lead to prolonged suppuration, and result in permanent perforation, or, more

rarely, in slowly progressive falling in of the tip or bridge of the nose. This deformity, when the patient is first seen, may be concealed by the swelling due to the abscess. I know of no method to prevent this.

Reference.

GOUGUENHEIM, Archiv für Laryngol., 1896, v. p. 69.

PERFORATIONS OF THE SEPTUM.

Perforations of the septum may be due to congenital defects; to syphilis; to tubercle or lupus; to trauma or surgical operations; to traumatic rhinitis; to gangrene; to abscess of the septum; to diphtheria, typhoid fever or other specific infection; and finally to the atrophic or perforating ulcer of the septum. They will again be mentioned in the descriptions of the various affections from which they may arise. It is convenient, however, to discuss the subject as a whole here, with special reference to aetiology and diagnosis.

Whilst it cannot be denied that a congenital perforation may occur, it must be extremely rare. The only examples known to me are those recorded by Zuckerkandl.

Perforations due to tertiary syphilis, congenital or acquired, are common, probably amounting to 50 or 60 per cent. of all cases. When their edges have healed, they may exactly resemble perforations due to the atrophic ulcer. Generally, however, they are larger and extend to the osseous septum. All perforations through the bony septum, in the absence of a definite trauma such as a surgical operation upon the septum, and in the absence of signs of other causal affections, may be confidently ascribed to syphilis.

Perforations due to tubercle and lupus are usually situated in the cartilaginous septum. The diagnosis depends upon the presence of active tubercular disease or of destruction and scarring as the result of it on the skin, or on the external or internal parts of the nose (see Chap. XII.).

Perforations resulting from the acute infections, such as diphtheria, abscess of the septum, typhoid fever, traumatic rhinitis, etc., cannot always be distinguished from those due to the atrophic ulcer. Sometimes a reliable history may be obtained, or the perforation may occur in early life, before the age at which the atrophic ulcer is met with. Perforations from any of these causes are rare.

Excluding the above, there remains a considerable number of perforations of the septum—some 40 to 50 per cent.—due to a peculiar form of ulcer with definite characteristics, the so-called atrophic or perforating ulcer of the septum. The ulcer is always situated on the lower part of the triangular cartilage, and never extends to the osseous septum, it is round

or oval, with thin, slightly raised edges, and runs a chronic, almost imperceptible course, ending in a small perforation which slowly extends in size.

THE ATROPHIC OR PERFORATING ULCER OF THE SEPTUM.

Aetiology. In inspiration the column of air entering the nose impinges first upon the moist mucous membrane on the anterior part of the septum, from which it takes up moisture and on which it deposits any dust that it contains. Should the patient be anaemic or alcoholic, or should the nasal secretion be deficient from any other reason the result is a deposit of dry mucus or dust on a small circular area of the cartilaginous septum. When the inspired air is exceptionally dry and full of dust, as may occur amongst the workers in certain industries, no predisposing cause is necessary. In a considerable number of patients no general or local predisposing cause can be found. That dust in the air especially tends to collect in this area may be seen from the effects produced on workers in factories where strong irritants such as bichromate of potash, arsenic, or corrosive sublimate, are used: for, as the result of the inhalation of the chemically irritating particles, acute ulceration and sloughing of this part of the septum may occur (Chap. VIII.). It may also be demonstrated experimentally by the lycopodium test (see page 29).

One other predisposing cause may be pointed out. If one nostril remain patent when there is deflection of the septum or other cause of unilateral nasal obstruction, it will have double work to do, and consequently a double strain will be imposed upon that area of its mucous membrane with which the air first comes in contact.

The effect of this collection of dry dust and mucus upon the mucous membrane is to produce changes in the superficial epithelium, as was first pointed out by Suchannek. The highly specialised, ciliated, columnar cells lose their cilia, become cubical, and are finally changed into squamous epithelium. This allows the crusts and dust to adhere more firmly than ever. The irritation of the crusts induces efforts to clear the nose, either by constant picking with the finger, or by violent blowing. The superficial epithelium is removed with the crusts, and excoriation of the mucous membrane results: this is shown by frequent slight attacks of epistaxis. The extravasated blood-clot and serous exudation have a still greater tendency to collect dust and to form adherent crusts. The continuance of this process leads to superficial ulceration which slowly becomes deeper and deeper until the cartilage becomes exposed and necroses. The mucous membrane on the opposite side of the septum becomes thin and undermined, if it is not already taking part in a similar process, and finally a perforation results. In the early stages the atrophy and degeneration of the septum are possibly aided by haemorrhages into the mucous membrane, followed by obliteration of some of the capillaries.

Zuckerkindl stated that the ulceration of the septum was predisposed to by the abnormal richness of the part in blood vessels, and that as the result of slight trauma, such as picking or forcibly blowing the nose, haemorrhages took place under the mucous membrane and lessened its vitality. This effusion of blood gives rise to an alteration in colour, a condition termed by Zuckerkindl *xanthosis*, which he said always preceded ulceration. This explanation appears to me insufficient alone, but it may be a factor in the process above stated.

Others have asserted that a small effusion of blood forms as the result of trauma, and that ulceration follows when this is infected by the *staphylococcus* or *streptococcus pyogenes*. That organisms would be found in these cases is of course to be expected, but the ulceration, as seen clinically, makes slow, almost imperceptible progress, and is not an acute affection, such as would result from infection with the pyogenic organisms.

When a perforation has formed, the ulceration may cease, and the surface epithelium on the two sides of the septum may spread over its edges. There is always, however, a tendency for crusts to adhere to the edges of the perforation and to produce its slow extension. The final perforation may vary in diameter from the size of a crow quill to that of a shilling or more, but the bony septum is never affected.

Symptoms. The patient may complain of slight symptoms, such as nasal obstruction, the sensation of a foreign body in the nose, and, whilst the ulcer is forming, of more or less nasal discharge and repeated slight epistaxis. The perforation itself gives rise to no symptoms, and will probably not be discovered by the patient. If the ulcer is seen before perforation takes place, it may be recognised by its thin, shallow, ill-defined edges, by its dry crusty surface, with minute haemorrhages and blood crusts, and by its tendency to bleed on the slightest touch. When a perforation has occurred and its edges have healed it is often impossible to determine its cause. A prolonged history without any acute symptoms, other signs of dry rhinitis, the age of the patient, a history of repeated epistaxis, the limitation of the disease to the cartilaginous septum, are all in favour of an atrophic ulcer.

Treatment. This is essentially that of the causal disease (see especially Rhinitis Sicca, Chap. IX.). For the perforation itself nothing can be done.

CHAPTER VIII.

ACUTE RHINITIS.

MANY varieties of acute inflammation of the nasal fossae are met with, and although it frequently happens in practice that one form cannot be sharply distinguished from another, for convenience of description they may be classified into:—

1. Simple Acute Rhinitis, the common "cold in the head."
2. "Drug" Rhinitis, a form of coryza due to the internal administration of certain medicines, such as Potassium Iodide.
3. Traumatic Rhinitis, or "Trade" Rhinitis, an acute inflammation arising from the local action of irritants inhaled into the nose.
4. Acute Purulent Rhinitis, a severe infection due to pyogenic organisms, to the gonococcus, etc.
5. Symptomatic Rhinitis, a local manifestation of a specific affection, such as measles.
6. Fibrinous, Croupous, or Membranous Rhinitis.
7. Acute Specific Inflammations of the Nose, such as erysipelas or diphtheria.

To these is sometimes added

8. Vasomotor Rhinitis, which includes those forms of rhinorrhoea, paroxysmal sneezing, etc., commonly known as "hay fever."

SIMPLE ACUTE RHINITIS.

Simple acute rhinitis is too well known to require much description. The affection is most common in children and in the aged: less common in adults, who are probably more resistant to this as to other infections. Morell Mackenzie, however, considered colds were comparatively rare in the aged.

Predisposing Causes. The most important predisposing causes are chronic nasal diseases, such as chronic rhinitis, hypertrophy of the turbinates, septal deflections, polypi, sinus suppurations, and—more than all—the presence of adenoids in children. Persons with narrow nasal fossae seem to take colds more readily and to suffer more severely than those

with wider noses. Amongst general causes may be mentioned impairment of the general health, living in close ill-ventilated or overheated rooms, want of sufficient exercise, and wearing of unsuitable clothing. Colds are also said to be more common in those with a rheumatic tendency and in those who sweat profusely.

Exciting Causes. Colds are probably most often due to some climatic influence, such as sudden changes in the weather; and it is possible that several people are simultaneously attacked because they have come under the influence of the same exciting cause, and not because the disease is infectious. Other commonly ascribed causes are a sudden chill, from exposure to cold or draughts, getting wet through, wet feet, and so on.

A cold is popularly supposed to be infectious. The whole character of the affection, the obvious dependence of the general symptoms on the local manifestations, the typical course, and the way in which a cold spreads through a household, point strongly in this direction. On the other hand, Friedreich and Hiller¹ obtained negative results from experimental inoculations: one attack does not confer immunity, even for a short period, as is the case with most other infectious diseases, and no specific organism has yet been discovered.

Symptoms. A cold usually comes on suddenly, with or without slight prodromal symptoms, such as headache, slight fever, malaise, or loss of appetite.

Locally, the onset is marked by a sensation of heat and fulness in the nose, often combined with itching or pricking, and quickly followed by sneezing and nasal obstruction. The nose in the earliest stage is dry, but discharge, at first watery and later mucous or muco-purulent, soon commences. Owing to the nasal obstruction mouth breathing becomes necessary, which, combined with the spread of catarrh, produces dryness of the throat and mouth. The voice acquires a "nasal" character: smell and taste are usually lost. In the severer cases there is redness and swelling of the tip of the nose and soreness around the vestibule. There may be headache, especially severe across the frontal region, facial neuralgia and conjunctival congestion with obstruction of the lachrymal duct and overflow of tears. Catarrh of the Eustachian tubes with deafness, tinnitus and a sense of fulness in the ears, and even ear-ache, are not uncommon. Sometimes sleep is prevented by the constant sneezing or by the discomfort of mouth breathing. As the cold passes off the discharge diminishes, but becomes more purulent and tenacious, the nasal obstruction subsides gradually, and finally the nasal functions return.

Occasionally in infants the symptoms are very severe. Complete nasal obstruction is easily produced owing to the narrowness of the nasal passages, and the difficulties of mouth breathing in infants especially during sleep have already been pointed out. Thus sleep may be rendered almost

¹Quoted by Morell Mackenzie.

impossible, sucking and even the administration of food by spoon become difficult, and the general nutrition is rapidly impaired. Under these circumstances there is a great tendency for the catarrh to spread downwards towards the bronchi and lungs, and this complication may easily prove fatal. Death may also occur from malnutrition due to want of food and sleep.

Pathology. At the commencement of a cold the mucous membrane of the nose appears red, congested, and dry, but it soon becomes moist, swollen, and sodden-looking. Seifert and Kahn¹ examined microscopically sections of the middle turbinate in a case of rhinitis of two days' standing. They found that the cilia and, in places, the superficial layers of the epithelium itself were lost. There was an infiltration of leucocytes between the epithelial cells and in the underlying connective tissue, especially around the acini of the glands. Often, in severe cases, there is mucoid degeneration of the epithelial cells, which may desquamate, and oedematous infiltration of the submucous tissue. In the later stages, especially in children, the discharge will be found to contain large numbers of degenerated epithelial cells.

Diagnosis. The diagnosis is always easy; but it must be remembered that an acute rhinitis may be the initial symptom of one of the acute fevers, such as measles, and that it may be complicated by acute catarrh of one of the accessory cavities of the nose.

Prognosis. The affection is usually trivial, but may be serious in the very young and in the very old. In infants ear and chest complications are frequent; in adults suppuration of the accessory sinuses, chronic or hypertrophic rhinitis, or polypi may result, especially from severe or repeated attacks. In the aged again bronchitis or other chest trouble must be guarded against.

Treatment. Numerous remedies which it is claimed will infallibly cut short a cold if taken early are constantly being recommended. Of these opium is probably the most reliable, and may be administered in the form of a full dose of Dover's powder at bedtime; or, as Morell Mackenzie recommends, five minim doses of the tincture may be taken before meals three or four times during the day. A single large dose of quinine (grs. v.-viii., in solution) or spirits of camphor (min. x.) may also serve to arrest a cold.

As a local remedy morphia and bismuth, as in the well-known Ferrier's snuff, are efficacious when used frequently and in large quantities. Strong inhalations of ammonia or of ammonia and carbolic acid, the basis of many "catarrh remedies," are sometimes effectual. Cocaine as a paint, spray, or in powder, has also been strongly recommended. Its immediate effect is to produce shrinking of the mucous membrane and to make a free passage through the nose. The constriction of the vessels is, however,

¹ *Atlas der Histopathologie der Nase*, Wiesbaden, 1895.

very temporary, and is followed by prolonged paralysis. To renew the relief obtained, stronger and stronger solutions of cocaine are required, and the drug is a much too dangerous one to be entrusted to a patient. The same remarks apply to the more recently introduced and highly-vaunted supra-renal gland extracts and their combinations with cocaine. These preparations are stronger astringents than cocaine and the effects last longer; the resulting paresis of the vessels is also greater and more persistent.

Even when a cold has become established much can be done to shorten its course and to alleviate the symptoms if the patient will submit to treatment. If there be any special reason to render a speedy recovery particularly desirable; if the patient be a singer or professional voice-user, or if he be in delicate health, careful treatment should be insisted upon. He should be confined to one room, which should be kept at an even temperature, or, better still, should stay in bed, a mild purge should be administered, and diaphoresis should be promoted by drugs, such as Dover's powder (grs. 10 at bedtime) or ammonium acetate,¹ as well as by the ordinary household remedies, such as a hot bath, plenty of hot drinks, sleeping in flannel, etc. A hot steam inhalation containing compound tincture of benzoin (one drachm to the pint of hot water) or menthol will often alleviate the distressing pain and dryness of the nose in the early stages. The water should be at a temperature of about 130°-140° F. Each inhalation should be practised in a warm room, and not be continued for more than five or six minutes, but it may be repeated three or four times during the 24 hours. Some patients state that even at this stage they obtain great relief by washing out the nose with a warm alkaline solution. Personally I have found more benefit from the local application of weak boracic ointment or of plain lanolin.

A very ancient remedy recommended at this stage is absolute abstinence from fluid, or at the most an allowance of less than two ounces during the 24 hours: it is said that this will undoubtedly stop the nasal discharge in two days, but the remedy seems worse than the disease. As the discharge lessens and becomes more purulent a simple alkaline nose lotion should be given, and, if the nose be at all sore, an ointment, such as vaseline or lanolin, should be frequently applied to the anterior part of the nose. Change of air with a suitable tonic such as perchloride of iron in large doses will probably complete the cure. In treating an exceptionally severe cold the possibility must be borne in mind that secondary infection of one of the accessory cavities of the nose may

¹ The following prescription may be used:—

R. Liq. morphiae m. 10
 Liq. ammon. acet. drs. 2.
 Aquae chloroformi to half an ounce.

Sig: One tablespoonful every 2 hours until sleep or profuse perspiration is produced.

occur, and also, especially in children, acute rhinitis may be the first symptom of one of the specific fevers, such as measles.

Prophylactic Treatment. Persons particularly subject to colds should be examined with a view to detect and remedy any chronic nasal affection such as hypertrophy of the inferior turbinates or polypi, and in children adenoid growths should especially be sought for. General precautions should also be adopted. The clothing must be warm and light, suited to the changes in the weather, and wool should be worn next the skin. Cold draughts must be avoided when over-heated or perspiring. The healthy action of the skin may be promoted by a cold sponge bath daily followed by thorough drying and rubbing; an occasional Turkish bath is probably also of value. Ill-ventilated, hot, stuffy rooms are always to be avoided. The patient should be recommended to sleep with the window open all the year round, though with delicate people a small fire in cold weather is desirable. Children, especially if ill-nourished, should be ordered a suitable diet, and cod liver oil may be given. The latter is often of great value.

DRUG RHINITIS.

The internal administration of certain drugs, more especially *iodine*, *arsenic*, and their compounds, may give rise to the local symptoms of a severe cold in the head: such as acute congestion of the mucous membrane of the nose and of the conjunctiva, profuse sneezing, and watery discharge. Constitutional symptoms such as fever are absent. It is probable that when iodides are given they are excreted by the glands of the nasal mucous membrane, and that as the result of chemical changes, iodine is set free on the surface of the mucous membrane and acts as a local irritant.

Treatment. The obvious treatment is to stop the administration of the drug; or, in the case of iodism, as the affection only arises when small doses of iodide are given, the coryza may be at once cut short by doubling the dose. If from the commencement potassium iodide is prescribed in doses of twenty to thirty grains, iodism will not result, or at any rate will be extremely rare.

TRAUMATIC RHINITIS.

Traumatic or "trade" rhinitis is an inflammation of the nose due to the inhalation of irritating particles, such as dust of various kinds, and is seen amongst millers, sawyers, brushmakers, librarians, and various metal-workers, especially workers in bronze. The particles of dust such as is met with in the above occupations are deposited on the anterior part of the septum and adjacent parts, where they act simply as mechanical irritants. This produces an affection similar to rhinitis sicca, under which heading it will be fully described (see Chap. IX.).

A much more severe form of the affection is met with amongst workers in certain chemical factories, where the dust acts as a chemical, as well as a mechanical irritant. Bécourt and Chevallier¹ have described a disease occurring amongst workers using bichromate of potash. The affection commenced as an ordinary acute rhinitis, but the discharge soon became purulent, and was often blood-stained. The mucous membrane of the septum rapidly ulcerated or sloughed, and the cartilage became necrosed. Epistaxis was common, and pieces of sloughing mucous membrane or necrosed cartilage were found in the discharge. Apparently the bony septum was rarely attacked, but small ulcers sometimes appeared on the inferior turbinate.

Delpech and Hillairet² have described a similar affection due to arsenic occurring amongst the makers of certain wall papers and artificial flowers, and it is said that the affection may even occur in people who inhabit rooms furnished with such papers. Mercury—especially the perchloride—may act in the same way.

Pathology. In all these cases the poison acts as a local irritant, and does not produce its effects through constitutional changes. The inspiratory column of air entering the nose first impinges upon the anterior part of the cartilaginous septum, and thus dust and other irritants accumulate there. This observation can be easily confirmed by examining the noses of people habitually exposed to the inhalation of dust, such as flour (see also Parker's experiment, p. 29).

Symptoms. The symptoms and diagnosis are obvious from what has already been said. In the more severe cases there is acute inflammation. The whole end of the nose is red, swollen and tender. The discharge soon becomes purulent and is generally blood-stained; severe hæmorrhages may occur. As the disease progresses the discharge may contain shreds or sloughs of mucous membrane or pieces of necrosed cartilage. The local appearances are those of acute ulceration of the septum.

In the milder forms the first symptom is usually epistaxis, slight but frequently repeated. Other patients seek advice for dryness of the throat. On examining the nose the appearances are similar to those of rhinitis sicca. The dust or other irritant is seen on the anterior end of the septum, on the middle turbinate, and, occasionally, on other parts. The mucous membrane of the septum is usually corroded in patches, and in old cases the cartilage may be exposed, or there may be a small circular perforation. On the septum enlarged venules will often be found, and occasionally small hæmorrhages may be seen in the mucous membrane.

Treatment. In the severer forms of the affection the patient must be at once removed from the noxious influence, when he will quickly recover; but more or less extensive damage may have already resulted. The treat-

¹ *Annales d'Hygiène publique*, 1863, xx. pp. 83-95.

² *Annales d'Hygiène publique*, 1869, xxi.

ment consists in irrigation with a mild antiseptic solution and the application of soothing ointments such as weak boracic acid ointment or lanolin.

In the milder form it is sufficient to wash the nose regularly with a simple alkaline lotion, and then to spray into it an oily solution such as pigmentum hydrarg. nit. (see Formula 23) or eucalyptus oil 1-40. If preferred, the oil may be applied by means of a small brush to the anterior part of the septum. The treatment of this affection is essentially similar to that of rhinitis sicca (see Chap. IX.).

PURULENT RHINITIS.

Acute purulent rhinitis is not uncommon in infants and young children, especially amongst hospital patients. The usual cause appears to be neglect of an ordinary cold, with absence of personal cleanliness, and impairment of the general health. The discharge usually contains pus, red blood corpuscles, and epithelial cells in considerable quantity. The latter consist at first of cylindrical and ciliated cells; in long-standing cases transitional and squamous epithelium—evidences of epithelial metaplasia—may be met with. Numerous bacteria are present, especially the ordinary pyogenic staphylococci, which are probably the active cause of infection.

The importance of this affection lies in the fact that, unless it is carefully treated, the degeneration of the epithelium is apt to continue until the nose becomes lined with squamous epithelium, and the condition known as atrophic rhinitis becomes established (see Chap. X.).

Gonococcal infection may also attack the nose, as has long been known. Edwards¹ in 1858 recorded cases in which adults had infected their noses by carelessly picking them with infected fingers. In some cases the affection was very severe, and led to ulceration and partial destruction of the nose. Such cases are extremely rare. Personally I have never seen one.

Recently gonorrhoea has been looked on as a possible cause of purulent rhinitis in infancy. Rosinski² recorded cases of gonorrhoeal ophthalmia in which the gonococcus was found in the nasal discharge, but without evidences of rhinitis. He concluded that the gonococcus could not attack ciliated epithelium. Hermann Weber, Fränkel,³ and others have seen cases of purulent rhinitis in babies as the result of direct infection from the mother at birth. In 1899 I investigated this subject, and examined the noses of a large number of infants suffering from gonorrhoeal ophthalmia. In most of the cases the nasal symptoms were quite slight and unimportant: in a few there was well marked purulent discharge with nasal obstruction and excoriation of the upper lip. In twenty cases cover glass preparations of the nasal discharge were made, and in all of them a diplococcus, morphologically resembling the gonococcus, was found. I have found a

¹ *Lancet*, 1857, i. p. 342.

² *Zeitschr. für Geburtshilf. u. Gynäkol.*, 1891, xxii. p. 216.

³ *Ziemssen's Handbuch*, 1874, iv. p. 129.

similar organism in two cases of purulent rhinitis in infants without any ophthalmia. It therefore seems possible that, although gonorrhoeal rhinitis is very rare in adults, it is not so uncommon in infants. It is usually associated with gonorrhoeal ophthalmia, and manifests itself as a simple nasal catarrh; more rarely it may give rise to a purulent discharge. As Rosinski says, the nasal mucous membrane probably opposes a strong local resistance to the action of the organisms.

Inherited syphilis is also associated with purulent nasal discharge, generally commencing in the third or fourth week after birth. It is commonly known as "snuffles," and will be again referred to (see Chap. XII.).

Symptoms and Diagnosis. The chief symptoms are nasal obstruction, purulent nasal discharge, with excoriation of the upper lip, and an impetiginous eruption on the face. The diagnosis depends upon the nature of the discharge, upon the history of infection, upon the associated symptoms, and bacteriological evidence.

Treatment. The treatment consists in thorough cleansing of the nose by frequent irrigation with mild antiseptic lotions, such as weak boracic acid or normal salt solution. A weak boracic or nitrate of mercury ointment should be applied to the nostrils if any excoriation is present. The general health requires attention. When complete nasal obstruction in infants is present there may be great difficulty in suckling them, and spoon feeding must be adopted. In older children cod liver oil may be given. When treatment is persistently carried out until all discharge has ceased, the prognosis is good, and complete ultimate recovery is probable.

SYMPTOMATIC RHINITIS.

Some of the most severe forms of acute rhinitis are met with as the initial symptoms, or as complications of the acute specific fevers. This is not to be wondered at when it is remembered that the infecting organism is usually inspired. Thus rhinitis is a constant symptom of measles, whooping cough, and influenza; it is very common in scarlet fever, typhoid fever, typhus, smallpox, chickenpox, and r  theln. Diphtheria and erysipelas may also affect the nose.

Nothing need be added here about these forms of rhinitis except that they are usually severe, are often purulent, are liable to be associated with or followed by inflammation of the accessory sinuses (see Chap. XV.), and are especially apt to lead to chronic rhinitis and important alterations in the nasal mucous membrane.

FIBRINOUS RHINITIS.

Fibrinous, membranous, or croupous rhinitis has been recognised for nearly 20 years, Hartmann, Moldenhauer, Seifert, and Henoch reporting cases in 1886 and 1887. The disease has attracted a considerable amount

of attention owing to its close resemblance to diphtheria. Clinical observers until about 1892 were convinced that fibrinous rhinitis was a distinct disease, but since the discovery and recognition of the Klebs-Löffler bacillus opinions have changed. Baginsky, Park, Abbott, Stamm, Ravenal, Gerber and Podack, and Pluder, as the result of bacteriological examinations, have found the Klebs-Löffler bacillus present in nearly every case, and regard the disease as a mild form of diphtheria. These views have been disputed by Abel, Van Starck, Fränkel, Sendziak, and Ritter among others, who have been unable to find the bacillus. The subject seemed to me a very important one, and I therefore collected and investigated over 50 consecutive cases during the years 1896-99. The chief conclusions at which I arrived have already been published, therefore I shall give only a summary of them here.

Clinical Features. The disease is not uncommon, is found almost entirely in children, and is most common in the autumn months. The chief clinical features of diagnostic importance are as follows.

(1) The child is usually thought to be suffering from a severe cold. There is nasal obstruction complete on one or both sides. The discharge may be profuse, clear, and watery, or consist of thick yellow matter: in a few cases it is very slight. It may be unilateral or bilateral, and is rarely foetid.

(2) Bleeding from the nose is met with in about two-thirds of the cases, and is a valuable diagnostic sign; often, however, it only occurs late in the disease. Sometimes the discharge is constantly blood-stained, and, rarely, severe haemorrhage may occur.

(3) There is usually more or less excoriation and eczema of the anterior nares, with impetiginous crusts on the upper lip and face.

(4) Examination of the nose shows great congestion and oedema of the mucous membrane, which bleeds easily when touched with the probe. The surface is covered by a thin, whitish, adherent exudation, which is limited strictly to the mucous membrane, and never extends to the vestibule. Sometimes the exudation forms a thick membrane which, on removal, may seem to be an almost complete cast of the interior of the nose. In about 25 per cent. of the cases the affection is unilateral.

(5) There may be a slight greyish film of exudation in the post-nasal space, which sometimes extends on to the fauces.

(6) The general symptoms are never severe; this is one of the most marked features of the disease. The children are often somewhat indisposed at the commencement, slight feverishness, headache, languor, diminished appetite may be noted, but nothing more than is usually met with in connection with a severe cold, and in some cases no history at all of initial disturbance can be obtained. The majority of the children do not cease to attend school or to play about as usual.

(7) The disease runs a subacute, almost chronic course, varying in duration from 3-12 weeks.

(8) The disease ends in complete recovery without any sequelae. In none of my cases were any signs of paralysis noted although carefully looked for.

Thus the symptoms are those of a severe cold from which the affection can be distinguished only by examination of the nose and by bacteriological investigation, although epistaxis, excoriation of the anterior nares and long duration of the nasal obstruction and discharge should always excite suspicion.

From diphtheria the disease can be distinguished clinically by its chronic course and by the entire absence of general symptoms and of paralytic sequelae.

From foreign bodies in the nose the diagnosis is best made by exploring with a hooked probe, under chloroform if necessary, when the foreign body or membrane, as the case may be, will be discovered and removed (see page 100).

Pathology. The membrane itself is identical with diphtheritic membrane, and consists of a fibrinous network, with layers of leucocytes and occasional epithelial cells. It contains numerous cocci and bacilli, amongst which the Klebs-Löffler bacillus may be recognised. According to Seifert, the fibrinous deposit lies on the epithelium, and there is no epithelial necrosis.

Bacteriology. I investigated the bacteriology of this affection in thirty-three consecutive cases which occurred in my practice in the course of two years. In the early stages the Klebs-Löffler bacilli could usually be demonstrated by means of simple cover-glass preparations of the discharge. By cultivation on Löffler's serum the bacillus was found in every case; in fifteen in pure culture, in eighteen other organisms—staphylococci, streptococci, etc.—were also present. The bacilli in twenty-seven out of the thirty-three cases were of the large variety. They showed the characteristic bipolar staining, metachromatism and polymorphism, and their growth on various culture media conformed in all respects to that of the true Klebs-Löffler bacillus. In twenty-three cases in which inoculation experiments were made the bacilli were found to be of full virulence. In one case the bacilli were rubbed into the tracheal mucous membrane of a rabbit, and gave rise to typical diphtheria. Virulent toxins were prepared from the bacilli, which toxins, as well as cultures of the living bacilli, could be neutralised by the ordinary diphtheria antitoxin sold for remedial purposes.

These experiments show that the Klebs-Löffler bacillus is constantly present in fibrinous rhinitis, and that the mildness of the affection does not depend on diminished virulence or feeble toxin-producing powers of the organism.

Further, a careful clinical and bacteriological examination was made of the throats and noses of persons who came into contact with these cases of fibrinous rhinitis. It was found that the disease could

never be definitely traced to infection from true diphtheria and that it never gave rise to an outbreak of diphtheria in others. This holds true of more than fifty cases in which careful inquiry was made. These results are not in accordance with those of Concetti (whose cases however were really true diphtheria), of Heaven, Eeman and Hunt who have each published an instance in which true diphtheria apparently originated from a case of this affection. Gerber and Podack also state that fibrinous rhinitis may arise from diphtheritic infection or be followed by diphtheria in the same patient, but their cases are not convincing. They accept the presence of the Klebs-Löffler bacillus in the throat as the certain proof of the diphtheritic nature of the affection, which, in this particular instance, is begging the question. Fibrinous rhinitis is however very infectious, for nine of my cases occurred in children belonging to four families, and it was often associated with an outbreak of slight sore throat or tonsillitis. The Klebs-Löffler bacillus could be obtained by cultivation from the throats of the affected persons, although none of them exhibited any definite clinical sign of diphtheria. The bacillus could also be cultivated from the throats of a considerable number of the persons who were exposed to infection but exhibited no sign of disease. These results are in agreement with those obtained by many of the earlier observers and more recently by Ravenel (who examined 10 cases), Pluder (6 cases), etc.

The conclusion therefore seems to me justified that fibrinous rhinitis is a mild form of diphtheria, bearing perhaps the same relation to it that lupus does to acute tuberculosis, or a simple abscess of streptococcal origin to diffuse cellulitis. It seems possible that it may arise by infection from a case of true diphtheria or that, under favourable circumstances, it might give rise to an outbreak of diphtheria, although ample experience proves that either event must be extremely rare.

It is very difficult to account for the mild nature of the disease itself and of the affections to which it gives rise. That it is not due to the feeble virulence of the bacilli my experiments have conclusively proved, and it is impossible to suppose that all the persons secondarily affected were more or less immune to diphtheria. The most probable explanation is that the toxins, although produced in full quantity, are not absorbed from the nose, and this again may be due to the fact that the necrosis of the tissues is less deep in fibrinous rhinitis than in diphtheria. The latter fact may be due to a difference in the virulence of the various organisms associated with the Klebs-Löffler bacillus, for the pyogenic organisms so frequently found, and probably always present, in diphtheria can hardly be supposed to play no part in that disease. In fibrinous rhinitis it may be that these pyogenic organisms are absent or when present are of very feeble virulence. This of course is purely conjecture, but there is at present no better explanation to offer.

Treatment. The diagnosis must be completed as soon as possible by

a bacteriological examination, and the patient placed in strict isolation. General tonic treatment, plenty of good food and rest, with quinine or Easton's syrup may be prescribed. The nose should be frequently irrigated with a mild antiseptic lotion, such as a solution of boracic acid, permanganate of potash, or sanitas with a little salt added. Iodoform or other insufflations rarely do good and removal of the membrane is followed by immediate recurrence. Eucalyptus oil (1-30) or *Pig. hydrarg. nitrat.* (Formula 23) should be applied to the anterior nares if they are excoriated. Complete recovery as a rule, ensues, but children must not be allowed to return to the society of others until all bacilli have disappeared from the nose as shown by bacteriological examination. On theoretical grounds the diphtheritic antitoxin ought to be of use in this affection but I cannot speak of its value from personal experience. I have only had one opportunity of using it and in this case two full doses produced no apparent effect, the disease persisting for nearly four weeks after its exhibition.

Bibliography.

FIBRINOUS RHINITIS.

- LACK. *Medico-Chirurgical Transactions*, 1898-99, vol. lxxxii. page 1 (which gives full references to date).
- HENOCH. *Vorlesungen über Kinderkrankheiten*, 1883, page 803.
- SEIFERT. *Münch. med. Wochenschr.*, 1887, xxxiv. p. 733.
- RAULIN. *Revue de Laryngologie*, 1890, x. p. 289.
- BAGINSKY. *Berl. klin. Woch.*, 1892, xxix. p. 183 and discussion, pp. 202 and 230.
- STAMM. *Arch. für Kinderheilk.*, 1891-2, xiv. p. 157.
- PARK. *Medical Record*, 1892, xlii. p. 113.
- CONCETTI. (Ref.) *Centralb. für Laryngol.*, 1893, x. p. 74.
- AEEL. *Deutsch. med. Woch.*, 1894, xx. p. 692.
- HANSEMAN. *Berl. klin. Woch.*, 1894, xxxi. p. 1127 and discussion; *Berl. klin. Woch.*, 1895, xxxii. p. 38.
- AASER. *Deutsch. med. Woch.*, 1895, xxi. p. 357.
- JOHANNESSEN. *Deutsch. med. Woch.*, 1895, xxi. p. 201.
- GERBER and PODACK. *Deutsch. Archiv f. klin. Med.*, 1894-5, liv. p. 262.
- MEYER. *Archiv für Laryngol.*, 1896, iv. p. 249.
- RAVENEL. *Medical News*, 1895, lxvi. p. 537.
- TREITEL u. KOPPEL. *Archiv für Kinderheilk.*, 1895, xix. p. 107.
- PLUDER. *Deutsch. med. Woch.*, 1896, xxii. p. 708.
- HEAVEN. *Public Health*, 1896, viii. p. 233.
- HUNT. *Lancet*, 1897, i. p. 593, and *Journ. of Laryngol.*, 1898, xiii. p. 492.
- PRICE BROWN. *Journ. of Laryngol.*, 1899, xiv. p. 225.
- EEMAN. *Annales de l'oreille et du larynx* (and discussion), 1896, xxii. 2e partie, p. 318, and *Journ. of Laryngol.*, 1896, xi. p. 213.
- YONGE. *Practitioner*, December, 1899.
- ABBOTT. *Principles of Bacteriology*, 1897, 4th edit., p. 309.
- WISHART. *Laryngoscope*, 1899, vii. p. 149.

CHAPTER IX.

CHRONIC RHINITIS. HYPERTROPHY OF THE INFERIOR TURBINATE. RHINITIS SICCA.

FOR convenience of description Chronic Rhinitis may be classified into Chronic Rhinitis Simplex, in which there is excessive nasal discharge and simple swelling or vascular turgescence of the mucous membrane: Hypertrophic Rhinitis, in which there is hyperplasia of the inferior turbinate: and Rhinitis Sicca, in which the nasal secretion is markedly deficient or has a tendency to form crusts. These varieties cannot always be sharply distinguished in practice. There is often no definite border line between vascular turgescence and hypertrophy of the inferior turbinate; the former passes by imperceptible stages into the latter, and both are commonly met with together. Again, although the secretion in Hypertrophic Rhinitis is usually excessive, it may be diminished, and the mucous membrane may be dry as in Rhinitis Sicca.

CHRONIC RHINITIS SIMPLEX.

Etiology. Chronic Rhinitis most frequently results from repeated nasal catarrhs, or from a severe catarrh such as may follow or accompany one of the specific fevers.

Predisposing Causes. The most noticeable predisposing cause is narrowness of the nasal fossae, congenital or acquired. Thus Chronic Rhinitis is frequently seen in association with septal spurs, a deflected septum or adenoids—particularly the last. It is especially common in Hebrews and in other races or families with a narrow type of nose. Nasal obstruction hinders free nasal respiration, prevents the prompt expulsion of any irritating particles which may enter the nose, and allows the nasal secretions to stagnate and cause irritation. Further, the increased negative pressure during inspiration behind the seat of obstruction reacts on the circulation and produces dilatation of the vessels of the mucous membrane, which increases the tendency to catarrh. Children with adenoids not only suffer from a constant succession of colds, but have more or less permanent swelling and congestion of the nasal mucous membrane and excessive nasal discharge.

Another well recognised predisposing cause is unhealthy hygienic surroundings or occupations. Those who live in damp places, in dust-laden atmospheres, or are exposed to sudden great changes of temperature, are very liable to take repeated colds, which may result in a chronic catarrh. The disease is much more common in damp and cold climates than in warm dry places. Impairment of the general health may also lead to a cold becoming chronic.

Pathology. As already shown, the mucous membrane covering the inferior turbinate and the adjacent parts of the nose is liable to become swollen under many conditions. In consequence of repeated catarrhs this swelling may become permanent. In simple vascular turgescence the anterior end of the inferior turbinate forms a smooth rounded globular swelling, usually pale in colour, and almost completely obstructing the entrance to the nostril. Clinical examination shows that this is due to over distension of the rich plexus of venous sinuses. On pressure with a probe the turbinate indents as if it were a bag of fluid, and the application of cocaine or other astringent solution quickly produces complete disappearance of the swelling. On microscopic examination, numerous leucocytes will be found, especially round the vessels and glands, but there is no increase of the connective tissue elements. The epithelial layers may be increased in thickness.

Symptoms. The most constant symptoms are nasal obstruction and excessive secretion. The secretion consists as a rule of muco-pus, but varies considerably in quantity and in consistence. It may be thin, watery, and profuse; or thick, scanty, and purulent. The nasal obstruction leads to mouth breathing with its attendant discomforts and evils. The obstruction often varies, being greater in certain positions, such as when lying down, and at different times of the day, or it may alternate, first one, then the other side of the nose being affected. There is usually considerable difficulty in blowing the nose, because the obstruction is chiefly in the inferior meatus, the normal channel for expiration. The difficulty in dislodging the secretion allows it to accumulate in the inferior meatus. There may also be impairment or loss of smell and of appreciation of flavours, and dull headache or mental inaptitude.

On examining the nose the swelling of the inferior turbinate as above described will be found. The mucous membrane may be pale and oedematous, or congested and red. Both the anterior and posterior nares must be examined before and after the application of cocaine, by inspection and with the probe.

As complications may be noted catarrh of the Eustachian tube and middle ear, catarrh of the lachrymal duct with lachrymal obstruction and conjunctivitis, post-nasal catarrh, pharyngitis, laryngitis, etc. Occasionally reflex symptoms are met with, such as neuralgia or asthma, which will be described later (see Chapter XIV.). Externally there may be a dermatitis of the vestibule and upper lip, especially in children, suppurative

pustules in the vestibule and redness of the tip or anterior part of the nose.

The **diagnosis** offers no difficulty when the attention is directed to the nose: but rhinitis may be overlooked when the patient complains only of reflex symptoms. It is important to remember also that the affection may be dependent upon some general cause, such as syphilis.

The **prognosis** is good provided the treatment is not neglected. There is but slight tendency to spontaneous cure, and both general and local symptoms tend to increase unless properly treated.

Treatment. The **local treatment** is the most important. In the first instance a simple alkaline lotion should be prescribed, such as Formula 2. If this fails, it may be varied by adding such drugs as carbolic acid (one grain to the ounce), chloride of ammonium, or chlorate of potash (five grains of either to the ounce). When the secretion is profuse, astringents may be tried; they must be very weak, as the nasal mucous membrane is extremely intolerant of such applications. One of the most useful astringent lotions is the combination of rectified spirit and glycerine of borax (Formula 6). In obstinate cases hazelin may be added to the alkaline lotion (Formula 9). As the nose becomes more tolerant these solutions may be increased in strength.

General treatment must not be neglected. Good food, tonics, such as iron and strychnine, should be prescribed, and the attention directed to any digestive or other trouble. When possible a change to a dry climate or to a bracing seaside resort may be strongly recommended. The general health should be regulated on the lines laid down for the prevention of acute rhinitis (see p. 131). Finally, any of the predisposing causes above mentioned, especially those producing nasal obstruction, should be treated, for a permanent cure is almost impossible until free nasal respiration is established. Adenoids, hypertrophies of the turbinates, considerable deflection or thickening of the septum must be removed.

When these means fail active measures, of which the application of the galvano-cautery is one of the most reliable, must be adopted to reduce the swelling of the mucous membrane. (For method of using the cautery see p. 51.) A somewhat broad cautery point should be chosen, and two or three linear cauterizations made along the entire length of the inferior turbinate. This produces but slight reaction, and is soon followed by considerable diminution of the swollen tissues. When the nostril is very narrow, to avoid injury to the septum and the risk of subsequent adhesions, it is sometimes preferable to use a sharp-pointed cautery and to plunge it deeply into the body of the inferior turbinate. Considerable shrinkage of the swollen tissue follows without much destruction of the superficial mucous membrane, but the beneficial effect of this method is slow to appear, and for the first few days there may be pain and increased disturbance.

Chemical caustics may be used instead. Chromic acid, trichlor-acetic

acid, nitrate of silver, and nitric acid have been especially recommended, and are probably of equal benefit. Personally, I prefer the last named. After cocainizing the nose the acid should be applied to the surface of the inferior turbinate by means of a small pledget of wool on a wooden or glass holder. The excess of acid should be immediately removed by mopping with pledgets of wool soaked in a solution of bicarbonate of soda.

By either of these means rapid improvement is commonly obtained, but two or three applications may be required at intervals of not less than a fortnight. Instead of using a cautery, Bryson Delavan has recommended submucous incisions. Under cocaine, a long narrow-bladed knife is thrust into the inferior turbinate, and the deeper structures freely divided. Contraction of the turbinate is said to follow without damage to the surface epithelium and without any reaction, but the method has not come into general favour. Occasionally, when the nostrils are extremely narrow, in order to provide a free nasal passage, it may be necessary to remove the anterior end, or more, of the inferior turbinate, even though this body is not hypertrophied. This operation will be described later (see p. 146).

HYPERTROPHIC RHINITIS.

Etiology and Pathology. Hypertrophic rhinitis is a sequel of chronic rhinitis simplex. Long-continued congestion leads to increase of the connective tissue of the mucous membrane and to enlargement or true hyperplasia of the inferior turbinate. This enlargement is usually circumscribed and affects either the posterior or anterior extremity; more rarely the whole length of the turbinate may be involved. The anterior end of the middle turbinate and the lower part of the septum may be similarly



FIG. 67.—HYPERPLASIA OF INFERIOR TURBinate. Early stage.

affected. In hyperplasia the surface of the mucous membrane is granular, papillary, or cauliflower-like; it is usually pale in colour, but may be deep red. See Figs. 67, 68.

Enlargement of the inferior turbinate is usually termed *hypertrophy*, and all the normal structures, including the mucous glands, venous sinuses, and even the bones are said to be increased (Klemperer, Citelli, and others). This is a mistake; the enlargement is due solely to increase of the connective tissue elements. In some cases I have found that the papillary outgrowths consist almost entirely of fibrous tissue, or fibrous

tissue which has undergone more or less myxomatous degeneration. In others the fibrous tissue, instead of forming localised nodules, is diffused throughout the thickness of the mucous membrane. The irregular formation and contraction of this tissue accounts for the papillary or mulberry-like surface of the mucous membrane. Kopetzky¹ ascribes the papillation to increase of the elastic fibres, of which also I can find no evidence.

Occasionally the enlargement consists mainly of lymphoid tissue. This may be seen in some specimens of hypertrophy of the posterior end of the inferior turbinate, and the pale irregular swellings which occur on the



FIG. 68.—HYPERPLASIA OF INFERIOR TURBinate. Late stage.

posterior end of the septum consist almost entirely of lymphoid tissue. The epithelial layers are often increased in thickness, but the superficial layer remains columnar and ciliated. Hyperplasias of the turbinal extremities may be more or less pedunculated, and resemble in structure the ordinary nasal polypus, but they are much less oedematous, and consist chiefly of closely-woven fibrous tissue instead of a loose areolar network distended with serum. Both contain a certain amount of glands and other normal structures of the mucous membrane.

The **symptoms** are similar to those of chronic rhinitis, but more severe. The secretion varies; it is usually profuse and mucous or mucopurulent, but occasionally is diminished in quantity, and the mucous membrane appears dry and crusty. When the secretion is tenacious there is a great tendency for it to accumulate in the inferior meatus, entangled, as it were, in the papillomatous outgrowths.

Diagnosis. Clinically the condition is distinguished from simple vascular engorgement of the turbinate by its papillary surface, by its hardness when examined with a probe, and by the fact that it does not disappear under cocaine. As already indicated, the two conditions are commonly associated, and the respective amounts of enlargement dependent on vascular turgescence and on true hyperplasia may be determined by the application of cocaine, when the former disappears and the latter remains.

¹ *Archiv für Laryngol.*, 1904, xvi. p. 388.

Treatment. When the hypertrophy is slight and associated with a large amount of vascular engorgement, treatment as for simple chronic rhinitis may be first tried. A few applications of the electric cauterity or caustics will usually suffice to clear the nose. If the mucous membrane be dry, the best treatment is to apply oily solutions with a brush or nebulizer. Formula 20 or 23 may be used.



FIG. 69.—PANZA'S NASAL SCISSORS.

When the nasal passages are structurally narrow, or when the hypertrophy is excessive, more radical means must be adopted to clear the nose. It must be remembered that the size of the inferior turbinate should bear a certain relation to the capacity of the nasal cavity. By anterior rhinoscopy it should be possible to see into the inferior meatus, and for a short distance between the inferior turbinate and the septum, but normally it



FIG. 70.—CARMALT JONES' SPOKE-SHAVE.

should not be possible to see through the nose into the post-nasal space. Bearing this relationship in mind, an attempt should be made to remove only so much of the inferior turbinate as is necessary to re-establish the normal conditions.

Removal of Anterior Hypertrophies. For the removal of hypertrophied portions of the inferior turbinate the cold wire snare is to be preferred. The snare shown in Fig. 71 has the great advantage that the wire loop can be quickly tightened until a firm hold of the growth is obtained, and then slowly screwed up. In this way the vessels are obliterated as they are divided, and there is no haemorrhage. Further, this snare will carry

a thick wire and will stand a great strain; points of importance, for the growths are frequently tough. The operation is performed under cocaine and supra-renal extract anaesthesia. Commencing at the anterior end of the inferior turbinate, repeated portions may be snared off until the whole inferior meatus is cleared.

Removal of Posterior Hypertrophies. When the posterior end of the inferior turbinate is affected the operation can also be carried out from



FIG. 71.—AUTHOR'S SNARE.

the front. The nose must be thoroughly cocainized and supra-renal extract applied so as to make the inferior meatus as roomy as possible. Then, if any anterior obstruction has been previously removed, it is usually possible to see the posterior end of the turbinate by anterior rhinoscopy. A snare threaded with a stiff wire (such as No. 5 piano wire) is used. The loop of the snare, about the estimated size of the growth, is bent at an angle to the shaft of the instrument, so that when the snare is in position the loop will turn towards the part to be removed. A little more of the wire is



FIG. 72.—METHOD OF ARRANGING LOOP OF SNARE. The plain line shows the shape given to the loop by twice bending it, the dotted lines show the positions it successively assumes when tightened.

now protruded from the barrel of the snare and the loop bent back into the direction of the barrel (see Fig. 72). By means of this double twist, the loop can be inserted through the inferior meatus, and hooked over the posterior end of the inferior turbinate; then as it is tightened it will be found to curl outwards and to obtain a firm hold of the part to be removed. The snare is then slowly screwed home.

If the surgeon does not succeed by this method it is better to give a general anaesthetic and to guide the wire loop over the posterior end of

the turbinate with the finger in the way shown in Fig. 73. The wire should be tightened up quickly until a firm hold is obtained, and then three or four minutes may be taken to complete the operation. By so doing there is little bleeding, and the danger of blood entering the air passages during the anaesthesia is lessened. When both turbinates are affected they may be simultaneously attacked and the wire loops alternately tightened. Of course the same operation may be carried out under cocaine, but the local anaesthesia is obviously unable to remove the



FIG. 73.—REMOVAL OF POSTERIOR END OF INFERIOR TURBINATE.

greater part of the discomfort caused. Again, cocaine causes shrinking of the turbinates, and makes it more difficult to feel them and to hold the wire loop in position with the finger. The greater the enlargement the easier is the operation.

Although in most cases of hypertrophic rhinitis removal of the redundant mucous membrane alone is sufficient, when the nasal fossae are unduly narrow it may be necessary to remove part of the inferior turbinate bone as well.

Anterior Turbinectomy. As already seen, the inferior meatus is narrowest at its extremities, and the inferior turbinate is especially large at its anterior end. Consequently, the removal of this part, an operation introduced by Richard Lake and known as anterior turbinectomy, will frequently add greatly to the roominess of the nose. It cannot be too strongly insisted on that no more of the inferior turbinate should be removed than is absolutely necessary. A general anaesthetic, such as nitrous oxide, should generally be employed; in robust patients cocaine is

sufficient. It is convenient for the operator to have the patient seated in an upright position, so that a good light can be thrown into the nose as in ordinary rhinoscopy. The instruments required are a stout pair of nasal scissors (Panza's) or shears, and a strong snare or the spoke-shave (Fig. 69). One blade of the scissors is passed down the inferior meatus, under the inferior turbinate, and about half an inch of the anterior part of the bone is cut through as close to the outer nasal wall as possible.

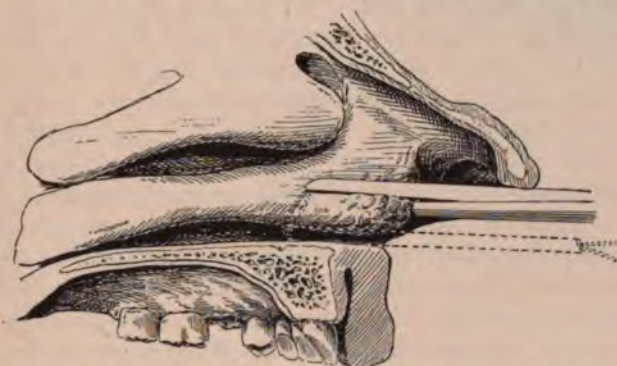


FIG. 74.—REMOVAL OF ANTERIOR END OF INFERIOR TURBINATE WITH SCISSORS AND SNARE.

Occasionally this piece of turbinate is entirely detached, but it is generally necessary to complete the operation by passing the wire of a strong snare along the cut made by the scissors, and to snare off the semi-detached portion, or it may be cut away with a spoke-shave. The spoke-shave alone may be used for the operation, but it is always better to notch the mucous



FIG. 75.—RESULT OF ANTERIOR TURBINECTOMY. *a*. Right inferior turbinate. *b*. Stump of left inferior turbinate. *c*. Left inferior meatus.

membrane of the anterior end of the turbinate with the scissors as above recommended, otherwise if the instrument do not cut cleanly, a partially detached piece of turbinate may remain hanging by mucous membrane.

Total Turbinectomy. Removal of the whole of the inferior turbinate is very rarely required. Owing to the width of the nasal fossae at their central parts it is nearly always possible to clear the nose even in the worst cases of nasal obstruction by removing the anterior and posterior ends of the inferior turbinate by the operative methods above described. But when the whole length of the turbinate is covered by papillomatous hypertrophied

membrane which completely fills the inferior meatus, and especially when the nasal fossa is narrow, nothing remains but to remove a slice of the entire length of the turbinate. The operation by means of the spoke-shave is easy and rapid, but has the objection that the amount removed cannot be accurately regulated.

It is best to give a general anaesthetic (nitrous oxide and oxygen usually suffices), and to operate with the patient sitting up, or, if recumbent, turned well over on to his side. The surgeon stands on the patient's left side, passes the spoke-shave through the inferior meatus into the post-nasal space, and hooks it on to the posterior end of the turbinate with the finger. By dragging the instrument sharply forwards, a large piece of the turbinate is easily sliced off. Haemorrhage is rapid at first, although it usually soon subsides. For this reason the anaesthetic should not be deep enough to abolish the cough or the swallowing reflexes, and means should be at hand for plugging the nose. Dundas Grant met with severe haemorrhage five times and "moderate" haemorrhage seven times in eighteen cases. The easiest method of packing the nose is to retain the finger in the post-nasal space, whilst long strips of gauze are rapidly pushed through the anterior nares until the whole nose, up to the finger in the post-nasal space, is tightly packed.

An alternative method of operating in these cases is to clip away the free border of the turbinate with nasal shears or scissors such as Panza's. This has the advantage over the operation with the spoke-shave in that there is more control over the amount of tissue removed. The operation, however, is rarely required; the cases in which it would be most useful are just those which can be successfully dealt with by the snare. It is insufficient for the most severe cases in which alone, as above mentioned, the spoke-shave should be used.

After-Treatment. Very little after-treatment is required; as a rule the less that is done the better. If the nose has been packed to arrest bleeding, the packing should be removed at the end of 24 hours, and not replaced. After the first two or three days the nose may be washed out with simple cleansing lotions. If the anterior end of the turbinate has been operated on, oily preparations are useful: the Pigment. Hydrarg. Nit. may be applied either with the spray or brush. For the first few days, food should be given cold; hot drinks should be especially avoided as they may cause haemorrhage. For the same reason the patient should be cautioned against too vigorous attempts to blow the nose.

Results. The after results of these operations are on the whole good. Patency of the nostrils by one or other method can always be established, but when extensive operations are performed the patient may suffer from dryness of the mucous membrane, not only of the nose, but of the post-nasal space, the pharynx and the larynx.¹ This is especially liable to occur when the nasal secretion has been deficient before operation. In

¹ See Discussion, *Proc. Laryngol. Soc. of London*, March, 1896-97, iv. pp. 88-97.

my experience it never occurs when profuse watery discharge has previously been present. The dryness usually yields in time and must be treated on the lines laid down for rhinitis sicca (see below).

Occasionally a condition not unlike atrophic rhinitis has followed complete turbinectomy.¹ This is especially liable to occur if purulent or muco-purulent rhinitis be present. In such cases, therefore, the operation should be performed only under very exceptional circumstances and after other methods have failed.

Bibliography.

Complete Turbinectomy.

ABERCROMBIE. *Journ. of Laryngol.*, 1896, xi. p. 181.

Discussion at annual meeting Brit. Med. Assoc., Sept., 1897, reported *Journ. of Laryngol.*, 1897, xii. p. 606, etc.

Discussion at Laryngological Society of London, May, 1897, reported *Journ. of Laryng.*, 1897, xii. p. 368, etc.

Anterior Turbinectomy.

LAKE. *Journ. of Laryngol.*, 1897, xii. p. 233.

Submucous Incisions.

DELAVAN. *New York Med. Journ.*, 1897, xvi. p. 798.

Pathology of Turbinal Hypertrophy.

CITELLI. *Archiv für Laryngol.*, 1902, xiii. p. 89.

RHINITIS SICCA.

This affection is characterised by dryness of the nasal mucous membrane. On examining the nose crusts are seen on the anterior parts of the septum and of the middle turbinate, and, more rarely, on the inferior turbinate. The crusts are small, adherent, and, in London, usually black, unless the patient is exposed to the inhalation of any particular dust, such as flour.

Causation. Rhinitis sicca occurs under three distinct conditions.

(1) The dryness may be due to anaemia of the nose and collapse of the vascular tissue of the turbinates. This form is met with typically in anaemic individuals, especially in women, often in connection with dyspeptic troubles and constipation. The mucous membrane of the nose, and particularly that lining the inferior meatus, will be found pale and shrunken. The nasal fossae appear wide, and small black mucous crusts are seen on the anterior part of the septum, on the middle turbinate, and more rarely over the whole nasal mucosa.

(2) The affection may be met with under almost directly opposite conditions. This form is most frequent in men of thirty to forty years

¹ Stewart, *Proc. Laryngol. Soc. of London*, 1897-98, v. p. 57.

of age and upwards, of the plethoric type, who are often gouty, and almost always addicted to alcohol. The mucous membrane of the nose is congested, dark red, and covered everywhere with small black crusts. The throat is congested and irritable, the fauces and uvula are thickened, the mucous surface has a dry, glazed appearance. The tongue is furred, the breath has a vinous odour.

(3) The affection may be due to unfavourable local conditions, such as excessive exposure to dust, flour, etc., or confinement to ill-ventilated overcrowded rooms (see also page 131). Of course these conditions may be, and often are, associated with either of the preceding.

Pathological Results. As already stated, the crusts tend to collect chiefly on the anterior part of the septum, that is on the spot where the inspiratory air current first impinges on the nasal mucous membrane. The crusts cause a certain amount of irritation, and the patient is apt to detach them by picking or by violent efforts at blowing the nose. This forcible detachment leads to excoriation of the mucous membrane and to permanent damage of the ciliated surface epithelium. The latter, repeatedly removed and regenerated, ultimately reverts to a simple type, loses its cilia and becomes squamous. The crusts now adhere more firmly than ever, and as the process continues definite ulceration is produced which may go on until the whole thickness of the mucous membrane is destroyed and the perichondrium exposed. Ultimately the cartilage necroses and a perforation of the septum is formed. The crusts adhere to the edges of this perforation, and it slowly increases in size, but never extends to the osseous septum. The separation of the crusts from the excoriated and ulcerated surface as above described gives rise to repeated attacks of epistaxis. Numerous dilated venules may be seen crossing the affected area, and often small blood clots are found, on detaching which epistaxis is at once produced. In this affection the bleeding may occur frequently, once or more daily, but is usually only slight in amount (see also pp. 83 and 125).

Symptoms. The patient may complain of nasal obstruction associated with irritation, stiffness of the nose, or pricking pains, but he most commonly seeks advice on account of the epistaxis or of the associated throat troubles. The latter consist of a feeling of constriction or of a lump in the throat, hoarseness, tickling cough, pricking or burning sensations. The nasal obstruction in this affection is often purely subjective. The objective features have already been sufficiently described and the diagnosis presents no difficulties.

Treatment. The patient's general condition requires careful attention.

In the *plethoric* cases alcohol must be strictly limited in amount or entirely interdicted. Smoking should be indulged in moderately, (cigarettes are especially harmful), and the diet must be regulated. Medicinal treatment may be commenced with the administration of an

aperient such as sulphate of magnesia or one of the natural aperient waters. In the well-to-do a "cure" at a watering place such as Carlsbad or Contrexéville may be strongly recommended. Subsequently treatment on general lines must be adopted.

In the *anaemic* cases tonic treatment must be ordered, such as a liberal diet, change of air, and outdoor exercise according to circumstances; digestive and other troubles must be inquired into and remedied. Medicinal tonics may also be prescribed.

Local Treatment. Although general treatment alone may suffice to effect a cure local measures are of great assistance. They consist in cleansing the nose with a non-stimulating alkaline lotion two or three times a day followed up by the application of oily solutions with a brush or atomizer. The thorough application of oil or ointment to the anterior part of the septum is most essential. It protects the mucous membrane, prevents the adhesion of crusts, arrests ulceration, and consequently prevents perforation and cures the epistaxis. When simple alkaline lotions are ineffective ammonium chloride or carbolic acid may be added (see formulae 1 and 3). Sometimes steam inhalations containing cubebs or menthol are useful, especially when the rhinitis is associated with marked laryngeal and pharyngeal symptoms.

When there is much tendency for mucus to accumulate in the post-nasal space, leading to constant hawking, and even to nausea and vomiting in the morning, the post-nasal region must be thoroughly cleansed by means of a special syringe or spray. In addition it is well to brush over the post-nasal space and the posterior wall of the pharynx with Mandl's solution or other astringent (see formula 25).

These measures will often be successful, provided that the patient's general habits can be corrected or that he can be removed from his unfavourable surroundings; but in many cases long continued treatment is necessary, and various modifications on the lines above indicated will suggest themselves. In obstinate cases it is sometimes well to rest the mucous membrane by plugging the nostrils with wool or gauze moistened with oil, and to encourage mouth-breathing. So long as air is excluded from the nose the nasal mucous membrane remains moist. This treatment may be persisted in for months, gradually diminishing the number of hours in which the nose is plugged. In spite of all that can be done, many patients—especially those in whom extensive degeneration of the epithelium has taken place, and in whom the anterior part of the septum has become covered with squamous epithelium—will require to use a nasal wash regularly. For such cases a solution of common salt (a teaspoonful to the pint of warm water) is the simplest and the best.

When One Nostril is Obstructed. In this condition the opposite side of the nose—if at all wide—does double work and is very liable to become dry. Under these circumstances it is generally advisable to clear the obstructed nostril. This usually means an operation on the septum,

and one should be chosen which entails the sacrifice of as little mucous membrane as possible. There is a tendency to dryness after all intra-nasal operations, and in these cases it will be well to plug the nose until healing is complete. The condition may even be made worse for the time being, but the ultimate result should be beneficial.

Of Epistaxis. The prophylactic treatment consists in the prevention of the formation of crusts on the septum by the application of oily preparations, and the patient should be cautioned against picking or rubbing the nose. As already seen, the bleeding area is always on the anterior part of the septum. Active bleeding may therefore be arrested by inserting a strip of gauze or wool covered with ointment into the affected nostril and firmly closing the anterior nares, thus bringing direct pressure to bear upon the affected part. When the means are at hand the bleeding may be temporarily arrested by applying cocaine and supra-renal extract, and then the bleeding points may be at once sealed with the electric cautery. In repeated epistaxis where this treatment has failed, the veins traversing the excoriated area of the septum may be obliterated by a few touches of the cautery. In the worst cases it may even be necessary to excise a piece of the mucous membrane.

Of Perforating Ulcer of the Septum. As already shown, the ulceration and perforation are really traumatic, and are due to the adhesion and forcible detachment of the crusts. Later the crusts tend to adhere to the edges of the perforation, and thus to produce its extension. The patient must be carefully instructed to apply oil or ointment to the ulcerated areas with a brush, and this must be continued until the edges of the perforation have soundly healed. In severe cases it is well to exclude the air from the nose by means of a plug of wool or gauze dipped in oil.

The following works may be consulted :

VICTOR LANGE. Heymann's Handbuch der Laryngologie u. Rhinologie, Bd. iii., Wien, 1899.

RIBARY. Archiv für Laryngol., 1896, iv. p. 301.



CHAPTER X.

ATROPHIC RHINITIS OR OZAENA.

Definition. Atrophic rhinitis is a disease of the nose characterized by an intensely foetid, muco-purulent crusty discharge, by undue width of the nasal fossae, and by atrophic changes in the mucous membrane. It usually commences in childhood, is sometimes hereditary, and is often associated with a peculiar physiognomy. This definition is imperfect, in that all these features are by no means present in every case. Thus in rare cases the foetor may be slight or unnoticeable, although the other symptoms are well marked; sometimes the nasal fossae are not especially wide, and more or less atrophy of the mucous membrane may exist apart from the other symptoms.

Aetiology and Pathology. Great variety of opinion has been expressed as to the aetiology and pathology of atrophic rhinitis; even its existence as a pathological entity has been called in question. The following are some of the chief theories which have been advanced from time to time:—

(1) That it is due to the decomposition of matter formed and collected in the accessory sinuses of the nose—an old theory recently revived by Michel and Grünwald. (2) That it is the final stage of dry rhinitis—Morell Mackenzie and others. (3) That it is the final result of hypertrophic rhinitis—Fränkel and many German authors, J. N. Mackenzie, and others. (4) That it is due to infection by a specific organism—Abel, Löwenberg, and more recently Gradenigo and others. (5) That it is due to tubercle or syphilis—Schäffer and other older authors. (6) That it arises from congenital non-development of the inferior turbinates—Zaufal. (7) That it is due to an inherited predisposition, as evinced by a peculiar shape of the skull—Hopmann—with congenital absence of the ciliated epithelium of the nasal mucous membrane, and its replacement by squamous epithelium. (8) That it results from purulent rhinitis in childhood—Bosworth.

To throw light upon some of the disputed points, for five years I carefully examined and noted the chief clinical features in a series of 150.

cases of ozaena, admitting only those in which the prominent symptoms, foetid, crusty discharge and undue width of the nasal fossae, were present. The chief results obtained may be briefly noted and compared with those of other investigators.

Sex. Of the 150 cases nearly three-fourths were females and just over one-fourth males. Wingrave gives the proportion as 49 females to 11 males; Macdonald as 49 females to 30 males; Gerber 293 females to 117 males; and, while a few observers deny this preponderance, most place the proportion as high as three to five females to one male. There is then no doubt that women are more often affected than men, or at any rate that they more often come under observation.

Age at which the Disease Commences. In nearly 40 per cent. of my cases the disease commenced at ages under five years; in approximately 35 per cent. between the ages of five and twelve; in 16 per cent. between the ages of twelve and eighteen; and in 9 per cent. at or after the eighteenth year. In some of the last group the disease was probably due to tertiary syphilis.

Morell Mackenzie believed that the affection usually began at or about fifteen to seventeen years of age, and saw only three cases in which it commenced in adult life. Bosworth states that purulent rhinitis, which according to him is the precursor of ozaena, is a disease of childhood, and atrophic rhinitis of adult life. Macdonald gives the average age, as based on patients' statements, at seventeen for women and eighteen for men, but believes the disease really dates further back. Wyatt Wingrave in 60 cases found that 6 commenced under nine years of age, 28 between nine and fifteen, 19 between fifteen and thirty, and 7 over thirty. Gerber states that the affection is common in children. Thus I find that the disease commences at a younger age than is generally stated, but two facts may to some extent lessen the difference between my results and those of others. I accept the onset of the purulent discharge, the earliest and most definite symptom, as the commencement of the disease, and this at once removes the difference between my statements and those of Bosworth, and possibly of other authors. Secondly, my patients have been partly drawn from the clinique of a children's hospital. I have, however, seen many definite cases with well-marked crust formation and foetor under the age of five, an observation which is of some importance with regard to aetiology.

The Exciting Cause. In the great majority of cases no reliable history can be obtained. The disease was sometimes ascribed to scarlet fever, to measles, to whooping cough, and more rarely to diphtheria, erysipelas, or smallpox. Most children, however, suffer from one or other of these affections, and it is difficult to attribute the disease to them with certainty. Frequently the disease was ascribed to repeated colds. In 4 per cent. of my cases the affection was probably due to tertiary syphilis, and in 6 per cent. to congenital syphilis, making 10 per cent. in all due to syphilis.

Macdonald states that the affection usually follows measles, scarlet fever or other exanthem. Wingrave states that of 60 cases one was due to smallpox, one to erysipelas and five to syphilis, inherited or acquired. Morell Mackenzie saw three cases due to inherited and three to acquired syphilis. Bosworth believes that the disease always follows a purulent rhinitis in childhood, which in turn is generally due to repeated colds and very rarely to the specific fevers. Most observers agree that some cases result from the specific fevers and more from repeated colds, but that in the majority the cause is unknown. In a few of my cases, adenoids, and in a few others, sinus suppurations have given rise to a condition extremely like atrophic rhinitis, and these affections might, following Grünwald, be added to the list of causes. This is hardly justifiable. It is much better in view of the complete and immediate success which follows suitable treatment to regard them simply as giving rise to conditions simulating ozaena.

The Peculiar Physiognomy sometimes met with consists, in typical



FIG. 76.—FACE OF CHILD, AGED 10, WITH ATROPHIC RHINITIS. Showing wide face, broad flat nose, and rounded nostrils.

instances, of a broad face, with prominent cheek bones and a broad flat nose. This is quite different from the depressed bridge or "saddle-backed" nose of inherited syphilis; on profile the nose appears quite

straight although hardly raised above the level of the face. The tip of the nose is tilted, so that the large round nostrils, which are often devoid of vibrissae, look forwards as well as downwards. This appearance has been recognised by most writers on the subject, although some state that the nose is usually "saddlebacked." The estimates of its frequency vary. I noted it in a little less than half my cases, but in some it was not well marked. Wingrave found it in twenty out of sixty, Gerber in 45 per cent. When this typical appearance is absent the nose is commonly large and broad, but it may present no external peculiarity.



FIG. 77.—MICROSCOPICAL SECTION OF MUCOUS MEMBRANE OF INFERIOR TURBINATE IN AN EARLY CASE OF ATROPHIC RHINITIS. Showing squamous epithelium.

In syphilitic cases the nose may of course show the typical "saddle-backed" appearance. The whole skull and face are usually wide. Thus Meisser found that in patients with ozaena in $97\frac{1}{2}$ per cent. the skull was of the broad type and in only $2\frac{1}{2}$ per cent. of the narrow type, whilst in normal individuals the proportion was 54 per cent. wide to 46 per cent. narrow.

The Inferior Turbinates. Increased roominess of the nose is invariably found. It appears to be due partly to small size of the inferior turbinates, and partly to congenital undue width of the nasal fossae. Whether it arises from atrophy or from congenital non-development of the inferior turbinates is doubtful. Although most people agree with the above

statement, a few surgeons, for example Bresgen, have published cases of ozaena with swelling of the inferior turbinates. All his cases (11) were associated with sinus suppuration, and were almost certainly not instances of true ozaena.

The Middle Turbinate. In seventeen of my cases the middle turbinate was enlarged, and in five there were small polypi. In ten cases Wingrave detected caries of the bone. Similar cases have been reported by others but without statistics.

Sinus Suppuration. Definite evidence of sinus suppuration was found in fifteen instances; in five in the maxillary antrum; in seven in the sphenoidal sinus; in three in the ethmoidal cells. In the other cases no definite signs of sinus suppuration were present. This subject will be discussed later in connection with Grünwald's theory.

Histology. Microscopical examination of the inferior turbinate was carried out in six cases, tiny pieces of this body being removed for the purpose. The results, which agree with those of Wingrave, may be summarised as follows:—(a) The ciliated columnar epithelium has disappeared, and its place is taken by stratified squamous epithelium. (b) The hyaloid basement membrane has disappeared, at any rate in places (Wingrave). Personally I do not feel assured that this is a definite change limited to atrophic rhinitis. (c) The glands in the submucous tissue are much decreased in number, and their epithelium shows signs of degeneration. (d) Immediately under the surface layer of epithelium is a thick stratum of round cells. Collections of similar cells are also scattered in the deeper parts, and are especially numerous around the vessels and glands. (e) The venous sinuses have largely disappeared. (f) The bone shows no changes. Cholewa and Cordes¹ in opposition to all other observers state that the bone shows signs of rarefying osteitis and active absorption. (g) The whole mucous membrane is less thick and more fibrous than normal.

Gottstein, Fraenkel, Schuchardt, Krause, Seifert and Bosworth agree in the main with the above description.

Relation to Tubercle. Two of my patients were suffering from phthisis: Brindel also records two instances. These figures are probably too small; obviously patients with phthisis are not likely to consult a rhinologist. Alexander² examined the chests of 50 patients with ozaena. In 22 there was phthisis, in 7 there were doubtful signs of it, in 4 there were other lung affections, and in only 17 was the chest healthy. These statistics are difficult to credit. Hamilton found phthisis in six out of 170 patients with ozaena. In several of my cases there was a strong family history of phthisis: in one, the patient's father, mother, one sister and two brothers had died of it. Wingrave found a tubercular history in 37

¹ *Archiv für Laryngol.*, 1898, viii. p. 18.

² *Archiv für Laryngol.*, 1903, xiv. p. 1.

out of 60 cases. These figures show that a close relationship between ozaena and tubercle exists, but indicate not that ozaena is tuberculous but that it predisposes to phthisis and to other lung affections.

Hereditary Predisposition is often very marked. In one family four children, three girls and one boy, and the mother were affected and the father's father was said to be. Two other children in this family were healthy. In another family four sisters, one brother and the mother were affected, whilst four brothers and the father escaped. In this instance the affected persons bore a strong family likeness to each other and had broad flat noses; those not affected, on the other hand, had narrow prominent noses. In six other instances there was a history of ozaena in a near relation. In the inherited, just as in the isolated cases, it will be noted that the number of females affected markedly predominates.

Evidences of Contagion. Although ozaena may occur in many members of a family, the peculiar way in which it selects certain members, namely, those with a particular physiognomy, shows that other influences besides infection are at work. Mackenzie did not believe the disease to be contagious, as he had seen many instances in which a nurse with ozaena had not affected the children under her charge. I have twice noted evidence of infection. In the first instance two children—both well marked examples of atrophic rhinitis—had been brought up together as sisters, but one was an adopted child, and no relation whatever to the other. In a second case a child was stated to have contracted the affection from residing and sleeping with an aunt who was similarly affected.

It will be best in the next place to consider the cardinal symptom of ozaena, namely, the nasal discharge, and the reasons that it assumes the form of large crusts and becomes foetid.

Formation of Crusts. The discharge consists of mucus, mixed with more or less pus, epithelial cells and debris, and contains numerous organisms. It usually forms large thick crusts, which are hard and black or greenish black on the surface, more fluid and yellowish green in the deeper parts. Cover-glass preparations stained with the various aniline dyes show the presence of numerous micro-organisms, among which may be distinguished diplococci, staphylococci, and occasionally streptococci: sometimes there are clumps of a small short plump bacillus resembling Hoffmann's pseudo-diphtheria bacillus, and a crowd of other bacteria, large and small. If the nose be cleansed, and then packed so as to exclude the air, the discharge is usually a thin and almost clear fluid, but sometimes it is yellow and opaque. This shows that the discharge as it first forms is fluid, and that the crusts are due to its retention in the nose, and exposure to evaporation from the constantly passing air stream. The following factors probably play the chief part in allowing the discharge to be retained in the nose:—(a) the undue width of the nasal passages, which diminishes the force of the expiratory air stream, and renders efforts to blow the nose less effectual; (b) the absence of the cilia of the

epithelium, which in the normal condition constantly sweep the nasal secretion backwards towards the pharynx; and (c) the unusual tenacity of the nasal discharge. The degeneration and complete disappearance of the racemose glands and the greatly diminished vascularity of the nasal mucous membrane, and especially that covering the inferior turbinates, render it highly probable that the secretion is from the first deficient in watery constituents, and the longer it is retained in the nose the more tenacious it becomes. The long retention of the discharge in the nose where it is constantly exposed to evaporation accounts for its drying and forming crusts.

The Foetor. The foetor is almost certainly the result of decomposition of the retained secretions, for if the nose be thoroughly cleansed and then packed so as to prevent crust formation, the discharge which is poured out is at first quite odourless. It is only when it has been retained for some time in the nose, and putrefaction has set in, that the characteristic stench is produced.

Whether the remarkable odour is due to some peculiarity of the original secretion, to the breaking up of fatty acids secreted by the degenerating glands as Krause suggests, or to the admixture of the pus with nasal mucus, or whether it is due to the presence of some particular organism, has been the subject of much discussion, and the question is still unsettled. Certainly the stench of ozaena is very characteristic and quite different from the odour arising from suppuration in the accessory sinuses, or that due to the presence of a foreign body or of necrosed bone in the nose. But otorrhoea, when foetid, has an equally distinctive stench, and the cutaneous secretions vary in odour in different parts of the body, as, for example, in the axillae and in the feet. It seems most likely that differences in the chemical constituents of the secretions enable different putrefactive organisms to flourish or to yield different chemical products as the result of decomposition. It may, however, be taken as proved that just as the discharge when secreted is fluid, so it is also non-foetid, and that the foetor, equally with the crusts, is subsequently produced in the nasal cavity. Therefore the crusts and the foetor are subordinate symptoms, and do not require any further consideration from a pathological point of view.

The source of the discharge, the causes of the atrophic changes in the mucous membrane, of the undue width of the nasal cavity, and of the disappearance of the inferior turbinates remain to be discussed. The various theories which have been advanced may be now profitably considered in the light of the above-mentioned facts.

1. Michel and Grünwald's theory that ozaena is a result of the decomposition of discharges coming from the accessory cavities of the nose was first suggested by Rheiniger more than a century ago.¹

¹ Michel believed that the accessory sinuses could be washed out by making a patient lie on his back with the head hanging over the edge of a table and filling the nose with fluid. From the success that he obtained by this method in the treatment of

Grünwald claims not only that he finds sinus suppuration or some other local source of discharge in every case of ozaena, but that he cures his patients simply by treating this local affection. In a series of 25 cases of ozaena suppuration was found, in the ethmoidal cells alone, in six; in the ethmoidal cells and other cavities in four; in the sphenoidal sinus in three; in the antrum in one; in the frontal sinus in one; in the middle meatus in two; and in multiple sinuses in three, while in five adenoids or enlarged tonsils were the chief source of the discharge. In 10 of these cases a cure was obtained solely by treating the local foci; in 9 there was great improvement, and in the remaining 6 localised disease was clearly shown to exist. In the 10 cured cases all nasal discharge ceased, showing that the cavities were the sole source of it. Bresgen also found local suppuration in 11 cases of atrophic rhinitis, but in all these there was *swelling* of the mucous membrane of the inferior turbinate. Grünwald finds support for his views in post-mortem records. Thus Zuckerkandl found disease of the accessory sinuses three times in 4 cases; Harke found it six times in 9 cases, Suchanek once in 3 cases, and Wertheim three times in 5 cases; Fränkel, Hartmann, and Krause relate a few similar cases. Minder in 1902 made a careful post-mortem examination of 5 cases and found three with and two without sinus suppuration. The importance of this pathological evidence is exaggerated, for Grünwald accepts any form of disease in a sinus, such as the presence of a cyst, as evidence of suppuration, and further, as will be shown later, there are weighty reasons for discounting the frequency with which pus or mucus is found in an accessory sinus post-mortem (see Chap. XV.). Clinical evidence is entirely opposed to Grünwald's theory. He himself relates only 25 cases, and in 5 of these he refers to the tonsils or post-nasal space as the source of the suppuration. Such cases cannot be admitted as genuine ozaena. Contrary observations may be quoted in overwhelming numbers. Thus Réthi found sinus suppuration in 2 out of 64 cases. Gottstein, Chiari, Wingrave, Macdonald, Gerber, and numerous recent observers state that sinus suppuration only rarely occurs, and that it is certainly not the main source of the trouble. Bronner¹ finds antrum suppuration in about one-fourth of his cases. Hajek thinks it is common. My own series of cases has been carefully examined with regard to this point, and shows fifteen instances of sinus suppuration; whilst in the remainder it could be excluded with a reasonable amount of certainty, on account of the method of treatment adopted.

As will shortly be stated, all my cases have been treated by packing ozaena he argued that the accessory cavities must be affected; but on the one hand this method is one of the most certain means of cleansing the nose, and on the other Neumann has shown by experiment that the fluid thus introduced very rarely enters the antrum (in his experience it entered twice in 18 cases), and probably the same holds true of other sinuses. Therefore Michel's argument is groundless.

¹ *Journ. of Laryngol.*, 1899, xiv. p. 551, and *Brit. Med. Journ.*, 1899, ii. p. 999.

the nose with strips of gauze. By this means the air is excluded, the discharge is prevented from drying, and if sinus suppuration be present, the pus coming from the sinus will at once be obvious. Moreover, such treatment is likely to increase rather than to diminish sinus suppuration, as it tends to prevent the outflow of the pus. Therefore if, under this treatment alone, the discharge can be stopped, sinus suppuration may be absolutely excluded.

Another argument of considerable weight is that ozaena commences at a much younger average age than sinus suppuration; in fact it is often seen in a marked and typical degree before any of the sinuses are sufficiently developed to produce the amount of discharge that forms.

The following observation is of interest in this connection, as it seems at first sight to confirm Grünwald's views. A female, aged thirty-five, had suffered from a bilateral foetid nasal discharge for four years, and had been treated by a rhinologist for two years as a case of ozaena. The nasal mucous membrane was very pale and anaemic, the air passages wide and filled with foetid crusts. After a fortnight's treatment both antra were explored and pus found. These cavities were therefore drained, and the patient was immediately cured without further treatment. Personally this seemed to me a sufficient reason for amending the diagnosis, and describing the case as one of double antral disease simulating ozaena. I have seen other similar cases in connection with ethmoidal and sphenoidal sinus suppuration. Occasionally also a foetid, muco-purulent discharge from the nose is seen in children suffering from adenoids. In these cases there is deficient power of blowing the nose, hence the accumulation of the discharge and its foetor. They are usually at once cured by removing the adenoids.

The only conclusion to be derived from a consideration of the evidence is that the discharge comes from the general surface of the nasal mucous membrane and not from any special locality. Döbeli¹ has watched the secretion actually forming in definite spots on the surface of mucous membrane.

2. The theory that ozaena is an advanced stage of rhinitis sicca, as described by Morell Mackenzie and many of the older rhinologists, is untenable. The diseases have nothing in common except the tendency to dryness. In simple dry rhinitis the crusts are small, consist of mucus, are found chiefly on the anterior part of the septum and anterior end of the middle turbinate, and there is no foetor. Further, rhinitis sicca is a disease of adults, the nasal fossae may be wide or narrow, there is no atrophy or mal-development of the inferior turbinates, and perforation of the nasal septum is common. This last condition is extremely rare in ozaena; I have never seen it except in the cases due to syphilis.

3. That atrophic rhinitis is a final result of hypertrophic rhinitis is perhaps based on false analogy, for there is no evidence worthy of the

¹ *Archiv für Laryngol.*, 1903, xv. p. 142.

name to support it. Schäffer and others state that the transition stage from hypertrophic to atrophic rhinitis requires eight to ten years, whilst, as already shown, the latter disease is frequently fully established in early life. It may even occur under five years of age. On the other hand, Bayer and others state that the transition may take only six months, in which case it should be possible to watch the changes occurring. Observations of this kind are wanting. Further, hypertrophic rhinitis is a disease of adult life, and is very rarely seen in early childhood.

4. The theory that ozaena is of microbic origin has some facts to support it. Abel, Cozzolino, and other competent observers have found a micro-organism, the bacillus mucosus, constantly present in the discharge. They state that it is not found in other diseases of the nose, and they believe it to be the cause of ozaena. The bacillus is found in almost pure culture in the deeper, fluid part of the ozaena crusts. It is 1.25μ broad, varies in length, is stained with methylene blue, but not by Gram's method. Arslan, Aucher, Brindel and others confirm the presence of this organism, but deny that it is the cause of the disease, as it is never found in the tissues. Both it and other organisms such as that described by Löwenberg are probably putrefactive bacteria. They may be the cause of the ozaenic stench, but there is no conclusive reason for believing that they have anything to do with the cause of the disease.

Belfanti and Della Vedova¹ in 1895 found the Klebs-Löffler diphtheria bacillus constantly present in ozaena, and expressed their opinion that the disease was due to it. Their observations have been confirmed by De Simoni² who found the bacillus constantly present in 25 cases, and by Odery Symes,³ who found it in twenty out of twenty-three cases; in seventeen of the last series the long, and in three the short, variety of the diphtheria bacillus was observed. These observers regard atrophic rhinitis as a chronic form of nasal diphtheria. Their observations are to some extent discounted by an investigation carried out by myself in 1899. I examined the bacteria of the nose by making cultures on Löffler's blood serum in 100 consecutive patients attending the outpatient department of the Children's Hospital, Paddington Green. The Klebs-Löffler bacillus was found to be present in 13, in 5 in pure culture; and Hoffman's pseudo-diphtheria bacillus was present in 52, in 16 in pure culture. These results show the widespread distribution of the organism, at any rate in London. Vassant⁴ found the Klebs-Löffler bacillus in 26 out of 100 normal noses; Thomas in 24 per cent. of 326 cases of nasal discharge.

I have examined a considerable number of ozaena cases and have not found the Klebs-Löffler bacillus present more frequently than in other

¹ *Journ. of Laryng.*, 1894, x. p. 343.

² *Journ. of Laryngol.*, 1897, xii. p. 145.

³ *Brit. Med. Journ.*, 1903, i. p. 484.

⁴ *Journ. Amer. Med. Assoc.*, 1897, xxviii. p. 395.

nasal affections. Moreover the pathological changes in atrophic rhinitis have nothing in common with the diphtheritic process.

5. With regard to tubercle. Patients with ozaena may suffer from phthisis or may have a marked family history of tubercle; thus Wingrave found a history of tubercle in thirty-seven out of sixty cases. But this does not help us far. Ozaena is certainly not tuberculous, and at the most it can only be claimed that the tubercular diathesis is a predisposing factor.

6. Zaufal's theory that in ozaena the inferior turbinates are congenitally absent, even if true would not explain all the symptoms of the disease; and further there is no evidence to show that the inferior turbinates ever are congenitally absent. Zuckerkandl examined the skulls of 252 children; in only one were the turbinates absent, and in this case there was a definite history of previous nasal disease. On the other hand, it is quite certain that ozaena may occur when the turbinates are fairly well developed. Certainly most observers agree that there is no actual atrophy of the bone to explain the small size of the turbinates, but it seems to me quite likely that ozaena may arrest the development of the inferior turbinates and that they may remain throughout life at the stage of growth they had attained when the disease began. It may even be that the growth of the whole nose, septum and nasal bones included, is arrested, and that this may partly account for the peculiar facies of the ozaena patient.

7. Hopmann believes that there is a definite type of skull in atrophic rhinitis. He finds that the length of the septum from the point of the nose to the posterior edge of the vomer is 5-15 millimetres less than normal, and that its proportion to the depth of the post-nasal space is as 71 to 29 in patients with ozaena, and as 77 to 23 in patients with normal noses; that is, that the nasal fossae are relatively shorter antero-posteriorly and the post-nasal space proportionately deep. Gerber has confirmed these measurements. Grünwald and Meisser have further shown that in ozaena the head conforms to the brachycephalic as opposed to the dolichocephalic type. Thus Meisser found that in patients with ozaena, the skull was of the broad type in $97\frac{1}{2}$ per cent., and of the narrow in $2\frac{1}{2}$ per cent., whilst in normal individuals the relative proportions were 54 per cent. of the wide type of head to 46 per cent. of the narrow. It is well known that a congenitally wide nose is one of the common predisposing causes of ozaena, and these measurements, which are not universally true, only prove that wide noses generally have a short antero-posterior diameter and occur in people with broad heads.

Gerber and Meisser believe that the type of head just described is a constant predisposing cause of ozaena. Further, they have found that the epithelium over the middle turbinate of the *unaffected* nostril in a unilateral case of ozaena was non-ciliated and squamous. They concluded this was congenital. Minder found epithelial metaplasia fourteen times

in fifty post-mortem examinations, five times with and nine without ozaena. But many causes will effect this transformation and even in an affected nostril the epithelium covering the middle turbinate may be columnar and ciliated, as I found on two occasions in which I examined polypi removed from cases of ozaena. There is then no conclusive proof that this epithelial metaplasia is congenital.

8. Bosworth's view that ozaena is usually the result of a purulent rhinitis in infancy or early childhood seems to me in accordance with the main facts and affords a rational explanation of the disease.

An infant or young child (usually three to five years old—Bosworth) gets a severe form of rhinitis as the result of repeated or neglected catarrhs or of some severe infection. The discharge soon becomes purulent, and is accompanied by rapid desquamation of the surface epithelium, as was first pointed out by Ranvier twenty-five years ago. This loss of epithelium is seen in all acute nasal catarrhs in children, and I have especially noted it in cases of fibrinous rhinitis. If constant desquamation and proliferation of the epithelium goes on for a long time, the columnar cells become squamous, that is, like all other highly specialised cells, they revert to a simpler type. Thus, although simple colds commonly pass off completely, and even fibrinous rhinitis and other severe infections as a rule recover in time, there is a danger, if the disease persist, of this epithelial metaplasia taking place—a long step towards atrophic rhinitis. Even when fibrinous rhinitis is carefully treated, crusting may persist for some months after the acute attack has passed off. The cilia of the nasal epithelium probably play a part of the first importance in cleansing the nose, and their absence alone is sufficient to account for the intractable nature of ozaena.

The following are the two chief conditions which seem liable to lead to a chronic purulent rhinitis, and may therefore be regarded as predisposing causes of ozaena:—1. Impairment of the general health, which may result from the severity of the exciting cause, from some diathesis, or from ill-nourishment. The last factor Bosworth denies, stating that his patients were all in good health. 2. Congenital excessive roominess of the nasal fossae. This acts by diminishing the force of the expiratory blast of air, and thus rendering it difficult to expel discharge from the nose. Consequently the secretion is retained in the nose, becomes dry and tenacious, and therefore still more difficult to expel. That the excessive roominess of the nasal fossae plays an important part in the causation of the disease is established beyond doubt, for (*a*) true ozaena is never seen without it. (*b*) In unilateral ozaena it will be invariably found that the affected nostril is abnormally patent, and the healthy nostril narrowed by a deflected septum. (*c*) Ozaena has occasionally developed after removal of nasal polypi (Macdonald, Schech, and others), and sometimes ozaena and polypi have been seen to alternate, the ozaena appearing after the polypi were removed, and disappearing again as the polypi re-formed (Guye). It is because the excessive roominess of the nasal fossae plays

such an important rôle in the production of ozaena that the disease so often seems to be hereditary and to be associated with a particular physiognomy. It is probably the shape of the head and not the disease which is inherited, for the peculiar facies is not always present even in old-standing cases, and is often seen without ozaena.

The atrophic changes in the mucous membrane which usually result from a chronic purulent rhinitis may be produced rapidly as the result of extensive ulceration. Billroth long ago described an extensive ulceration of the nose, and noted that the resulting scar tissue was covered by squamous, instead of by ciliated, epithelium. As the result of tertiary syphilis, the mucous membrane of a large part of the nose may be replaced by fibrous scar tissue, its glands and vascular sinuses may be destroyed, and its ciliated epithelium replaced by squamous. Even the turbinate bone may become necrosed, and thus in a short time, and at any age, the nose may be transformed into a condition closely resembling that produced by a long-continued purulent rhinitis in childhood. The syphilitic cases are often distinguished from the others by the fact that the disease is more or less limited—it may be to one nostril or to part of one nostril, or there may be extensive destruction involving the middle turbinate and the septum, or even the nasal bones, as well as the inferior meatus of the nose. When healing of the ulceration has occurred and the syphilitic element has been eliminated, the pathological and clinical features of these cases are similar to those of ordinary ozaena, and they require the same treatment.

Some other symptoms of ozaena may be briefly referred to. The infiltration of the mucous membrane with round cells, the disappearance of the venous sinuses and glands, and ultimately the thin, shrunken sclerotic mucous membrane, may all be accounted for by the constant irritation of the decomposing discharge. Why irritation should sometimes produce hypertrophy, sometimes atrophy, is not clear, but the latter is probably the result of a long-continued and more severe irritation which impairs the nutrition of the parts. The pressure of the crusts may also produce anaemia of the underlying mucous membrane. In ozaena there is occasionally hypertrophy of the middle turbinate, in which region the action of the decomposing discharge is probably less intense. Whether there is ever active atrophy of the inferior turbinate *bone* must, I think, remain an open question. I do not know of any definite clinical evidence which proves that this gradual wasting away or shrivelling up of the turbinates, which is often loosely talked about, really occurs, and microscopical examination reveals no sign of rarefying osteitis. On the other hand there is no evidence that the bones are congenitally deficient. But granting that the disease commences in early life, the changes in the mucous membrane, and especially the obliteration of the vessels, may readily be supposed to prevent further development of the bones. One would then expect to see cases in which the turbinates retain their infantile development

throughout life, and others in which the turbinates are well developed. This is, I think, the fact. We often find almost complete absence of the inferior turbinates in infants with ozaena, and, on the other hand, well developed turbinates in old-standing cases in which the disease commenced in adolescence. Thus the size of the turbinate is not an indication of the time that the disease has lasted, but rather of the age at which it commenced. It is impossible to deny that pressure on the bone may be produced by contraction of the cicatricial mucous membrane, and that this may induce absorption, but the deprivation of the blood supply would be more likely to arrest development than to cause active atrophy. It is difficult to believe that the atrophy can be caused by pressure of the crusts as is sometimes stated. Of course in ozaena due to syphilis, the turbinate bones have often been destroyed.

Thus we see that the main symptoms of ozaena, the crusty foetid discharge and the atrophic changes in the mucous membrane can all be explained by considering it to be the final result of a purulent rhinitis commencing in early life, or of active destruction occurring later. Further, in consequence of the marked structural changes which are both constant and permanent, the disease has a distinct right to be considered a definite pathological entity. Whether it should be termed ozaena, from its most prominent symptom, or atrophic rhinitis, is a matter of no very great importance, but it may at least be said that the former is just as convenient and correct as the latter.

The **diagnosis** may be made by attention to the above-described features of the disease, and need not be further considered.

Complications. A disease of this kind must exert considerable influence upon the neighbouring regions. The unhealthy nose cannot fulfil its functions of warming, moistening, and cleansing the inspired air. The post-nasal space, the pharynx and larynx, are usually inflamed and dry. They may appear as if glazed with a film of mucus, or they may be covered with large muco-purulent crusts. There is a predisposition to phthisis, bronchitis, and other chest affections. There is often deafness, due to Eustachian obstruction or to chronic middle ear catarrh. Morf¹ found the ears affected in 44 out of 80 cases. There is complete loss of smell, except in a few cases, which probably commenced late in life. The general health suffers partly from the ill effects of the local trouble, of septic absorption, etc., and partly from the mental distress caused by the unfortunate sufferer's social disabilities. The association of sinus supuration, and more rarely of nasal polypi, has already been noted.

Treatment. No purpose would be served by discussing all the various methods of treatment or by giving a list of the drugs and medicaments which have from time to time been recommended and considered infallible by their introducers. These are almost daily added to and their number alone shows their uselessness. I shall only attempt

¹ *Archiv of Otolaryngology*, 1894, xxiii. p. 271.

to indicate the principles which ought to underlie all methods of dealing with this disease. If the pathology of the affection and the changes which have taken place in the nasal mucous membrane are borne in mind the treatment is really very simple, and success depends less upon the means employed than upon the manner in which they are used. The essential points are (1) to cleanse the nose, (2) to prevent the drying of the discharge, (3) to improve the general health, and (4) to treat any complications.

1. The Cleansing of the Nose. This must be thorough, and provided it is so, it matters very little by what means it is effected or what antiseptics are used. It is well for the surgeon himself to attend to this point and to see the patient frequently until the latter has learnt to carry out the treatment. An unirritating antiseptic or an alkaline lotion may be used; a solution of common salt in warm water (a teaspoonful to the pint), with the addition of a little sanitas, is as pleasant and as effectual as any. With this the nose should be thoroughly syringed until all the crusts are detached and washed away. Then the surgeon should inspect the nose, and if necessary direct the stream of water directly on to any remaining crusts, or gently detach them with a probe. A solution of hydrogen peroxide applied on a wool mop is often very effectual in loosening hard adherent crusts. The discharge having been removed the mucous membrane may be lightly rubbed with cotton wool mops on holders. The friction seems to stimulate the membrane, which becomes reddened, and fresh secretion is poured out and is wiped away. I recommend this rubbing not so much as a stimulus to increase the nutrition of the atrophied turbinates as because I believe it promotes a more thorough cleansing of the nose than is obtained by washing alone.

The cleansing must be carried out twice daily by the patient. About half a pint of solution is required for each washing, and it should be used with an ordinary nasal syringe or with a Higginson's. This is less dangerous than the nasal douche, and far more effective than any spray; "sniffing up" the lotion is almost useless. The importance of thorough cleansing must be impressed upon the patient, and it is well for the surgeon to superintend it himself until the patient has mastered the art.

2. The Prevention of Crusts. To prevent the discharge drying and undergoing decomposition, it is only necessary to exclude the air. Gottstein was the first to recommend the introduction of large tampons of cotton wool into the nose with the idea of exciting irritation, and of causing a more fluid secretion, thus leading to the detachment of the crusts. Although simple obstruction of the nostrils and exclusion of the air is sufficient to prevent the drying of the discharge I believe better results are obtained by packing the whole nose. For this purpose I employ strips of the double cyanide gauze, as I find that with it the plugs never

become foetid. It is known that the cyanide salt has a strong inhibitive action upon bacterial development, and it certainly seems better to employ an antiseptic gauze rather than plain wool. Moreover this particular gauze has the advantage over most others of being almost non-irritant. If the gauze is difficult to remove or if the nostrils become sore, it may be moistened with oil such as the Pigment. Hydrarg. Nit. or weak ichthyol ointment (10 per cent.) may be spread on it. The packing should be worn continuously day and night, and removed only to cleanse the nose. As a rule the patient soon learns to tolerate the nasal obstruction and breathes comfortably through the mouth even during sleep. Occasionally headache is produced, or the general discomfort is so great that the packing can only be worn for a few hours or so at a time, until tolerance is established. I am often told that the treatment is so uncomfortable that patients will not carry it out. This is not my experience, which now extends over some two hundred cases. On the contrary, patients soon get accustomed to the treatment and there is often great difficulty in persuading them to abandon it. It is not nearly so painful as Gottstein's method, but even if it were, most of these patients would willingly submit to anything which offers them a prospect of relief. And in this connection a patient may be absolutely assured that if he carries out the treatment as above detailed, and packs the nose properly, the stench will be immediately abolished and he may freely mix with his fellow-creatures without the least fear of causing offence. The objection that mouth breathing is harmful is easily met. It is surely less pernicious to respire through a healthy mouth than through a diseased nose, which poisons rather than purifies the air.

These two methods of treatment should be continued until all purulent discharge has ceased and there is no tendency for the foetor to return. This can be determined by omitting the packing for a day or two. If the treatment has been successful, and in some cases it requires weeks, in others months, the nose will remain free from discharge or at most contain a few small mucous non-foetid crusts such as occur in ordinary dry rhinitis. The packing may then be entirely omitted, or be inserted for only a few hours daily; thus it may be employed at night alone if it does not interfere with sleep. Of course the syringing must still be continued regularly, and to prevent the dryness of the nasal mucosa various oils may be employed as sprays or applied with a brush. The best medicaments for this purpose are Eucalyptus oil (1 part to 20 or 30 of almond oil) or *Pignmentum Hydrargyri Nitratis* (see Formula 23).

3. General Treatment. General treatment should never be omitted. The best results are probably obtained by tonics, such as cod-liver oil and iron, combined with change of air, preferably to the seaside. The last was formerly vaunted as a specific for ozaena, and it certainly does good, presumably by improving the general health.

4. Treatment of Complications. The chief complications are suppuration

in the accessory cavities of the nose, dry muco-purulent catarrh of the pharynx, larynx and trachea, and chronic middle ear catarrh.

After the nose has been packed for some days, a careful examination must be instituted to discover any sign of sinus suppuration. Should pus be seen in any particular region, the fact must be carefully noted, and if it be frequently seen, the suspected cavity should be explored. Thus, if pus appear under the middle turbinate, the antrum should be punctured and washed out. If a streak of pus be constantly seen in the olfactory cleft or on the roof of the naso-pharynx, the sphenoidal sinus should be examined. In these cases it is usually possible to obtain a view of the ostium of the sphenoidal cavity, by applying cocaine and supra-renal extract to the posterior end of the middle turbinate, aided, if necessary, by pressing the middle turbinate outwards with a Killian's speculum. As the nose is already wide, it is better to do this than to remove any portion of the middle turbinate.

Some other methods of treatment may be more briefly alluded to.

Massage to the nasal mucous membrane by rubbing it gently but rapidly with a pledget of wool wrapped round a probe has been much recommended, and I have often tried it. I doubt if it be of much benefit, except as a means of cleansing the nose as above described.

Paraffin Injections. Recently Lake and Brindel have recommended the restoration of the shrunken turbinates by the injection of melted paraffin wax. The injections cause an artificial painless enlargement of the turbinate, and lessen the calibre of the nasal fossae. Brindel uses paraffin melting at 60° C., and injects two to three cubic centimetres at each sitting. He recommends that the first injection should be made into the posterior portion of the inferior turbinate, and a second a few days later into the anterior portion. This is to avoid the danger of phlebitis of the facial vein, which occurred when single large injections were made near the anterior part. The only ill effect noticed after the injections was slight oedema under the eyes, which disappeared in a few days. Lake recommends the use of a paraffin melting at 105° F. Half a drachm to two drachms may be required. As a result of successful injection the patients express themselves as "being far more comfortable, and of feeling the air passing through the nose." The formation of the crusts has been more rapidly checked and has not recurred. Brindel and Moure have used the method in 70 cases, in some of which fifteen months had elapsed before the date of their last report: they speak very highly of it. Stella¹ reports good results in 40 cases, using paraffin with a melting point of 112° F. It certainly seems to fulfil one of the indications of treatment, and, if carefully employed, to be free from danger. I have used it in some 40 cases during the last two years, and have been favourably impressed with it. The patients all state that they are better and feel less obstruction in the nose. Many have been at once able to discontinue

¹ *Archives de Laryngol.*, 1904, xvii. p. 820.

the packing. The only ill results have been an occasional painful tender swelling at the angle of the eye and nose. This has usually followed a first injection, and once or twice has caused great oedema of the lower eyelid. It has always subsided in two to three weeks, and left no permanent ill effect. Of course the appearance of the interior of the nose is much improved. Two or three injections are required. I use Lake's syringe (see Fig. 78), and paraffin wax melting at 105° . This and the syringe are heated up to 135° – 140° F. to allow time for the injection.

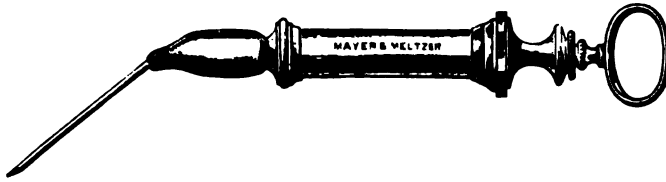


FIG. 78.—LAKE'S SYRINGE FOR INTRANASAL INJECTIONS OF PARAFFIN.

When hardly any inferior turbinate is present, the treatment is very difficult to carry out.

Cupric Electrolysis was introduced by Jouslain in 1892; numerous cures have been ascribed to it. The nasal cavities should be cleansed, cocaine applied, and the parts dried. The needle attached to the positive pole is then passed into the inferior or middle turbinate—usually the former—and the steel needle into the septum. A current of three to ten milliamperes is allowed to pass for about ten minutes. Five to ten or more applications may be required at intervals of not less than seven to fourteen days. Occasionally severe pain from excessive inflammation has been observed, and Yonge in 15 cases twice noted that a small perforation of the septum was produced. In the others, no serious ill-effects were observed.

Cheval reported 91 per cent. of cures, many of which were obtained by a single application: M¹Bride¹ reported five cures in 6 cases: Braat² five in 15. Yonge³ tried the treatment in 15 cases, of which 2 were cured and 5 much improved; he believed the method superior to any other procedure. Gouguenheim⁴ reported good results in 7 cases. A committee of the Belgian Otological Society, specially appointed to investigate the treatment as carried out by Cheval, reported no improvement in 7 selected cases. I have no personal experience of it, but in the face of the above report it is impossible to recommend the method, which, moreover, already appears to be falling into disuse.

The application of **irritants**, such as iodine, or cantharides, or strong solutions of antiseptics to special parts of the nose, where the crusts mostly congregate, has not in my hands produced beneficial effect.

¹ *Edinburgh Medical Journal*, 1899, xlvii. p. 217.

² *Journal of Laryngology*, 1899, xiv. p. 319.

³ *Lancet*, 1901, ii. p. 1262.

⁴ *Annales des Mal. de l'Oreille, etc.*, 1898, xxiv. p. 393.

Neither has the dry treatment by insufflations with boracic acid, iodoform, iodol, etc., given good results: rather it seemed to aid the formation of crusts, although diminishing the foetor.

The application of the **cautery** at a white heat, as recommended by Morell Mackenzie, and at one time by Lennox Browne, seems to be quite contrary to proper principles of treatment, as it must still further damage the atrophied mucous membrane.

Serum therapy was introduced by the Italians after the discovery of the diphtheria bacillus in ozaena, and large doses of diphtheritic antitoxin have been employed but with very doubtful results. Belfanti and Vedova cured half their patients, but Gradenigo obtained no benefit in 14 cases. Holger Mygind¹ obtained good results in 10 cases, but ascribes the therapeutic effect to the horse's serum and not to the antitoxin.

Curettement of the mucous membrane has also been employed, and quite lately has been recommended by Moure in the early stages of ozaena, but it is difficult to understand how its action can be otherwise than harmful.

There is no known means of accomplishing a rapid or a perfect cure of this troublesome affection. The simple methods above described have stood the test of time, are based on rational principles in accordance with the pathology of the affection, and give uniformly good, if not brilliant, results.

A few words as to **prognosis** may be added. If the disease is met with in its early stages, before atrophy has occurred, treatment may be entirely successful, and the patient may be cured. But even then the wide nasal fossae will remain, and there will be a tendency to relapse; therefore every care must be taken to keep the child in good general health, to prevent colds, and when they occur, to treat them energetically and thoroughly until every trace has disappeared. When the disease has become established, and structural changes have taken place, a cure is not to be expected, but great improvement may even then be obtained. The discharge will almost cease, and will entirely lose its purulent character, its horrible foetor, and its tendency to form large crusts, but the nose will remain wide and the turbinates will not develop. The atrophied mucous membrane will always be dry, and little pieces of dried mucus will adhere to it, to remove which the nose must be daily syringed. All other treatment, however, may be omitted, and the syringing soon becomes a matter of daily routine, and gives the patient very little trouble. So long as he continues it he will remain well, but in most cases a relapse is to be feared if it is omitted altogether.

Bibliography.

Pathology.

ROBERTSON. *Lancet*, 1893, p. 983.

HOPMAN. *Archiv für Laryngol.*, 1894, i. p. 35.

¹ *Journ. of Laryng.*, 1898, xiii. p. 379.

- J. N. MACKENZIE. New York Med. Journ., 1897, lxx. p. 107, and Burnett's System of Diseases of the Throat and Nose, 1893, vol. i.
- GRÜNWARD. Die Lehre von den Naseneiterungen, 2nd edition, München, 1898; Journal of Laryngol., 1902, xvii. p. 514, and Archiv für Laryngol., 1902, xiii. p. 250.
- BOSWORTH. Diseases of the Throat and Nose, New York, 1889, vol. i., p. 162.
- MEISSER. Archiv für Laryngol., 1898, viii. p. 533.
- COZZOLINO. Annales des Mal. de l'Oreille, etc., 1899, xxv. p. 1.
- GERBER. Archiv für Laryngol., 1900, x. p. 119.
- TREITEL. Archiv für Laryngol., 1904, xvi. p. 336.
- MINDER. Archiv für Laryngol., 1902, xii. p. 328.
- HARKE. Beiträge zur Pathol. u. Therap. der oberen Luftwege, Wiesbaden, 1895.
- WYATT WINGRAVE. Med. Press and Circ., 1893, lvi. p. 659.

Paraffin Injection.

- LAKE. Lancet, 1903, Jan. 17th, and Proceedings of Laryngological Society of London, 1902, ix. p. 92.
- BRINDEL. La Presse Médicale, 1902, x. p. 546; and Therapeutic Gazette, 1902, xviii. p. 848.
- MOURE. Journ. of Laryngol., 1903, xviii. p. 303.

Electrolysis.

- Discussion on, in the Belgian Society of Laryngology; Journ. of Laryngol., 1897, xii. p. 551.
- YONGE. Lancet, 1901, ii. p. 1262.

CHAPTER XI.

NASAL POLYPUS.

INFLAMMATION OF THE ETHMOIDAL REGION OF THE NOSE; OSTEITIS AND PERIOSTITIS OF THE ETHMOID.

Definition. Nasal polypi may be provisionally defined as new formations springing from the ethmoidal region of the nose, consisting mainly of a loose network of fibrous tissue, together with more or less of the other tissues normal to the region. They may be round, oval or pyriform, are often pedunculated, have a pinkish or bluish semi-translucent appearance, vary in size from a currant to an acorn or larger, and give rise to nasal obstruction with its associated symptoms.

I hope to show that nasal polypus is simply a localised oedema of the nasal mucous membrane due to disease in the underlying bone.

Historical. Nasal polypus has been described by medical writers from Hippocrates downwards. The latter not only describes the main clinical features of the growths, but gives practical suggestions for treatment. He recommended that a string should be passed through the nose and drawn out through the post-nasal space into the mouth, and that a sponge, having about the same diameter as the nostril, should be attached to the string, and forcibly pulled through the nose from behind forwards. This plan has been recommended in quite recent times. According to the researches of Morell Mackenzie, the following are some of the chief landmarks in the history of nasal polypus. Celsus, in the first century, recommended the use of caustics as the best treatment. The name "polypus" was used by Galen from the supposed similarity of the growths to the sea polyp. He recommended the use of astringents for their removal, and was strongly opposed to the knife. William of Salicet introduced the method of strangulation by tying ligatures round the pedicle of the growth, and, when this was not possible, advocated removal with forceps. Boerhaave thought polypi were membranous sacs caused by the prolongation into the nose of the mucous membrane lining the ethmoidal cells. The secretion of these cells became thick, was consequently unable to escape, filled up the cell, and protruded its mucous membrane into the nasal fossae. This

view has been recently re-stated by Bosworth. Morgagni and Valsalva, in the 17th century, recommended the removal of the lamina of the bone to which the polypus was attached in order to prevent its recurrence. This recommendation was endorsed by Ferguson and Pirogoff. The use of the snare dates apparently from Robertson, who described his invention in the *Edinburgh Medical and Surgical Journal* for 1805. His snare was afterwards modified by Wilde and Hilton, and is the original of those in present use.

The older surgeons considered that nasal polypi were of the nature of true tumours, either myxoma, adenoma, or fibroma, and this opinion has held its ground till quite recent times. The accepted modern view is that

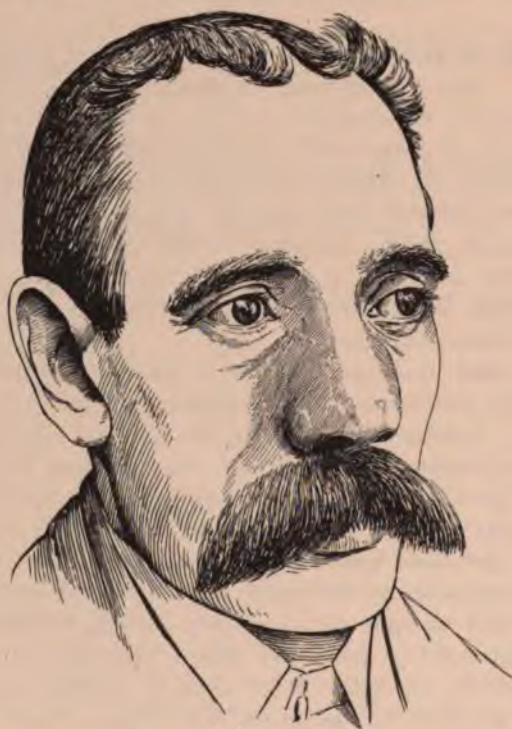


FIG. 79.—GREAT WIDENING OF BRIDGE OF NOSE, RESULTING FROM PRESSURE OF NASAL POLYPI.

polypi are in some way the products of inflammation, but probably many would still agree with Morell Mackenzie, who states concisely that the causes are unknown. I shall first describe the clinical and pathological features of nasal polypi, and then return to the discussion of their aetiology.

Clinical and Pathological Features. 1. Polypi are most often multiple and bilateral; there may be three, four, or more growths in each nostril; as many as ten polypi may perhaps be found simultaneously, but

such statements as that sixty (Schech), or even one hundred (Heymann) may occur, though often made, are probably inaccurate. Without being dogmatic, it is well to remember that polypi have a tendency to rapid recurrence, and that nothing approaching such a number of growths have ever been removed from a nose at one sitting, or been found post-mortem. Occasionally only a single polypus is present.

2. Polypi vary in **dimensions** from the size of a pea up to a large mass four or five inches long and one or more broad. A single polypus, especially, may attain enormous dimensions, and may protrude both from the anterior and posterior nares. When several large polypi are present, they may fill and even distend the affected nostril and greatly widen the bridge of the nose. (Fig. 79.)

3. Polypi may be **pedunculated, sessile, or papillary**: the first arrangement is probably the most common. The attachment can only be satis-



FIG. 80.—BONY CYST OF ANTERIOR END OF MIDDLE TURBinate WITH POLYPOID MASS ATTACHED.

factorily demonstrated when the growth is examined *in situ* post-mortem, or when a large piece of bone with a polypus attached is removed in one piece. Figure 80 represents a polypus growing from the anterior extremity of the middle turbinate. The growth springs from a broad base running along the free border of the bone, and there is no definite line of demarcation between the tumour and the healthy tissues, although before removal the growth appeared to be pedunculated. Zuckerkandl suggests that the shape of a polypus depends upon its place of origin; when it springs from a smooth surface the growth will be sessile, when from a sharp edge it will be pedunculated. This is probably incorrect, the shape being chiefly determined by influences coming into play later, such as the action of gravity and of blowing the nose. Thus the longer a growth has existed, the more likely it is to be pedunculated.

Sessile, papillary and pedunculated growths are often associated in the same nostril, showing that they are all probably due to one and the same cause and are essentially of the same nature. For example, as the

result of infiltration the mucous membrane over the middle turbinate may become irregularly thickened, and its surface raised into little projections. This may further develop so that each projection becomes a separate growth, or it may develop as a whole and form a large papillary-like polypus (see Fig. 81).

4. Polypi may occur at any age, but are most common between the ages of twenty and thirty and upwards. They are very rare in children, and are probably never congenital. Morell Mackenzie, in over two hundred cases, saw none under fifteen. Alexander, in eight hundred and fifty cases, saw ten under ten years of age. M'Bride, in a hundred and fourteen, saw two under ten, and Natier, who has published a series of cases in young



FIG. 81.—POLYPOID MUCOUS MEMBRANE FROM MIDDLE TURBINATE.

people, saw two only under ten. Heymann saw nine under sixteen, and six under ten in three hundred and ninety-two cases. I have seen eight cases in children, the youngest being three years of age. The few recorded instances of congenital polypi appear to be doubtfully authentic. The youngest recorded case was five months old (Le Roy), and even this allows sufficient time for the growth to have originated after birth. Cardone has reported a case at two years old, and Heymann one at six months.

5. **Frequency.** Polypi appear to be rather more common in men than in women. According to Zuckerkandl they are met with as frequently as one in nine post-mortem examinations. Heymann gives the frequency as once in twenty-eight in general hospital patients. This seems to be a far greater frequency than is met with in this country. Even in the clinique of a special hospital the cases do not form more than 5 or 6 per cent. of the total numbers.

6. **Site of Attachment.** Polypi may spring from any part of the mucous membrane covering the ethmoid. They appear to grow most commonly from the edge and under surface of the middle turbinate, from the uncinate process and the region of the bulla ethmoidalis, more rarely from the septum or upper part of the nose: their origin is often deeper

than is suspected clinically. The most exact evidence is that obtained from post-mortem records, and Zuckerkandl gives the sites in the following order of frequency as the result of his examinations:—lips of hiatus semilunaris; infundibulum; ostium ethmoidale; ostium frontale or maxillare; margin of middle turbinate; from cleft in middle turbinate; bulla ethmoidalis; ethmoidal labyrinth; septum (3 cases). He states that polypi never arise from the inferior turbinate nor from the roof of the nose, although, as Grünwald points out, he describes two instances of the latter.¹

7. Tendency to Recurrence. One of the most marked features of polypi is their great tendency to recur after removal. Recurrences may be extremely frequent and extend over long periods, but vary much with different forms of growth. One of my patients had large polypi removed every fortnight for three years, and yet was never once free from growth



FIG. 82.—NUMEROUS SMALL NASAL POLYPI AS SEEN BY POSTERIOR RHINOSCOPY.
(From a drawing by Proctor Hutchinson, kindly lent by J. W. Bond.)

during that time. In other cases there has been a history of continuous recurrence for upwards of twenty years, and such instances are quite in accordance with general experience.

8. Histology. Microscopical examination shows that polypi consist chiefly of a loose network of fibrous tissue, the meshes of which are filled with serous fluid. In places the stroma may have undergone myxomatous degeneration, but a purely myxomatous growth is never found. Throughout the polypus there are scattered collections of round cells, usually most marked near the free margin and around the vessels and glands. The surface is covered by a more or less complete investment of epithelium, which is usually two or three layers thick, and continuous with the epithelium of the surrounding mucous membrane. In some polypi, especially the pedunculated variety and those of more rapid growth, the epithelial layers decrease in thickness towards the apex of

¹ Zuckerkandl, *Norm. u. Path. Anat. der Nasenhöhlen*, pp. 79-81.

the tumour, and finally become only a single row of cells or cease entirely. When there are several layers of cells the epithelium is normal in character, the superficial row being columnar and ciliated; where there is only a single layer of cells, these are usually cubical in shape and have no cilia. Occasionally the epithelium is squamous in places. Further, polypi usually contain more or less glandular tissue, especially marked near the attachment of the growth. These glands are found in nearly every specimen, but vary greatly in amount. In some they are numerous enough to give the section the appearance of an adenoma; in others they are few and far between. They are especially numerous in the sessile growths, in which

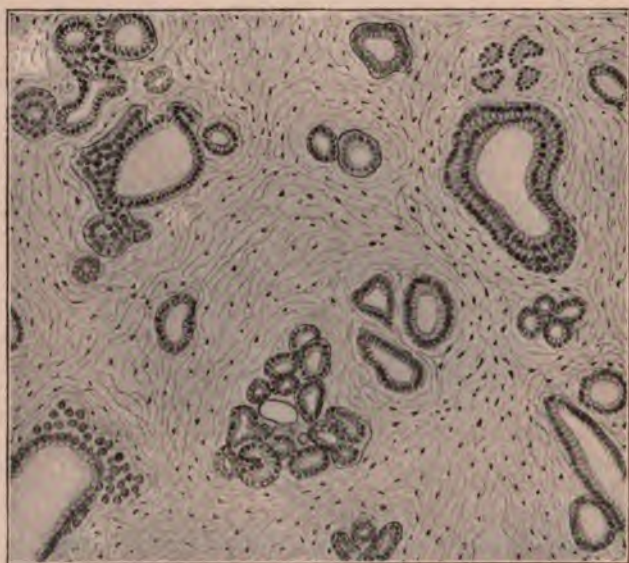


FIG. 83.—MICROSCOPICAL SECTION OF A NASAL POLYPUS SHOWING NUMEROUS GLANDS, SOME NORMAL, OTHERS WITH DILATED ACINI AND DEGENERATING EPITHELIUM.

actual increase of glandular tissue may occur (Billroth). They are less numerous, or may be absent, in the rapidly growing pedunculated growths. Sometimes the glands are normal; at others the lumen of the acinus is greatly distended and the lining epithelium is partially degenerated or lost. Polypi, and especially those in the posterior region of the nose, are often cystic. The cysts may be single or multiple and vary greatly in size; I have met with polypi which seemed to be merely large thin-walled cavities filled with clear fluid. The cysts are mostly the dilated acini of glands, the ducts of which are obstructed by inflammatory infiltration, or by contraction of newly formed fibrous tissue. The large cysts contain a thin albuminous fluid with a little mucin, the smaller cysts may have thick contents, consisting of fat, epithelial cells, mucus, pus and chalk. Small false cysts are also frequently met with, which have no true cyst wall,

but are simply distended areolar spaces containing serum (Okada). Kalischer¹ has demonstrated the existence of nerve fibres in polypus.

From this description it will be seen that *polypi consist simply of the normal structures of the mucous membrane of the nose in varying quantities and in variable arrangement* with a certain amount of serous exudation and round-celled infiltration. One tissue may predominate, and the growth may be firm or jelly-like. A firm slowly growing polypus may resemble a fibroma, or if its tissue has undergone myxomatous degeneration, a myxoma. Another growth, from its excessive vascularity, may resemble an angioma; another containing an excessive quantity of glandular tissue may resemble an adenoma; and a growth, the epithelial surface of which is thickened and papillary, may resemble a papilloma. The pedunculated tumours show the most typical polypoid structure with their loose fibrous network and large spaces distended with serum. The sessile growths approximate more closely to the normal structure of the mucous membrane, but between these there is every intermediate gradation. Virchow stated that polypi contained large quantities of mucin, but Köster proved that the fluid was really serum.² It is the result partly of oedema and partly perhaps of inflammatory exudation. Polypi usually contain a considerable number of eosinophile cells, and the double pyramidal crystals of cholesterol will separate out of the fluid if it is kept in a moist chamber. These Charcot-Leyden crystals are not found especially in the cases associated with asthma, but are apparently most plentiful when most eosinophile cells are present.

9. **Relation to Sinus Suppuration.** Grünwald states that nasal polypi are almost pathognomonic of sinus suppuration. In thirty-three cases of polypus he found definite evidence of sinus suppuration in twenty-eight; and in a further series of fifty-three cases, in forty-three, although a careful study of his records would seem to substantiate only thirty-eight. Suppuration was found most commonly in the ethmoidal cells, alone or in conjunction with other sinuses. Thus, Grünwald states that sinus suppuration was found in 82 per cent. of polypus cases; whilst in the remainder no abnormal secretion was seen in the nose. The majority of observers have come to different conclusions on this point. Alexander in 104 cases found suppuration in only one-third. Kronenberg in 44 carefully observed cases found sinus suppuration in 27, and no abnormal secretion in 6. McBride, Chiari, Skrodzi and others found suppuration in a still smaller percentage. Allowing for a considerable margin of error, especially in the older observations when the means of diagnosis were admittedly imperfect, and granting that whenever pus is seen in the nose sinus suppuration is present, it seems safe to assume that suppuration is certainly not present in more than 60 per cent., and cannot be demonstrated with certainty in more than from 30 to 40 per cent. of polypus cases.

¹ *Archiv für Laryngol.*, 1895, ii. p. 260.

² *Berliner klin. Woch.*, 1881, p. 526.

10. **Changes in the Bone.** Although as early as the seventeenth century the observation was made that the removal of a lamina of bone was the best means of preventing the recurrence of nasal polypus, no systematic examination of the bone was made until quite recent times. Woakes was the first to draw attention to this point. He claimed that polypus was not a disease *per se*, but only a prominent symptom of a disease of the ethmoid bone, which he called "necrosing ethmoiditis." He described a series of morbid changes beginning with fibrosis, going on to obliteration of the arteries, and absorption of the bone, with development of bony cysts, polypus, and granulation tissue, until finally interstitial death of the bone, or necrosis, resulted. Woakes described the clinical features of the disease as first an enlargement, then a cleavage, of the middle turbinate, with swelling of the overlying mucous membrane; from the cleft in the bone polypi might project. A fine probe inserted into this cleft would detect bare, friable, carious bone, which might also be found by passing the probe under the turbinate into the anterior ethmoidal cells, or above it into the posterior ethmoidal cells. The clinical evidence was supported by microscopical examination. Thurston examined three specimens of bone removed by Woakes, and found signs of bone disease in all. Martin examined twenty portions of bone, and reported that in ten there was absorption of bone, and in two necrosis; in eight the bone showed no evidence of disease. In a few cases there were cysts in the bone, and in all the muco-periosteum showed profound changes, chiefly of the nature of fibrosis, with thickening of the arteries.

These observations have been much disputed. Zuckerkandl examined the bone underlying polypi, and stated that it was usually healthy, although it might show changes due to hyperplastic periostitis. Luc found no evidence of bone disease in two cases. Others state that, as a matter of clinical experience, they have never seen definite necrosis of the ethmoid in cases of polypus, and others again, without advancing any argument to support their views, state that bone changes occur in a small percentage, but that they are the result, and not the cause, of the polypi. Hajek examined twelve cases and found bone disease in eight, in three rarefying osteitis, and in five condensing osteitis. In the other four cases there were signs of periostitis. Chiari, whilst admitting that the bones were often affected in polypus, considered that there was no causal relationship. Baumgarten has also found changes in the bone underlying polypoid mucous membrane. Heymann and Alexander agree that bone changes may occur, and assert that they are of the nature of rarefying osteitis. They have never seen caries or necrosis, and further, they have seen polypus without bone changes. Reichert examined thirty cases, and came to substantially the same conclusions as Woakes.

Histological Evidence. The subject seemed so worthy of further investigation that during the years 1898 and 1899 I carried out a considerable amount of work on the subject, examining the bone in thirty

cases of nasal polypi. These investigations I have subsequently continued. The bone was removed, either with the snare or by curettement, and was subsequently fixed, decalcified, embedded in paraffin, and sections cut. The sections were stained by Ehrlich's haematoxylin, and counter-stained with rubin and orange or by van Gieson's method. In every case of polypus, whether suppuration was present in the nose or not, definite changes were found in the underlying bone (Figs. 84 and 85). From the study of a series of sections it seems probable that the affection

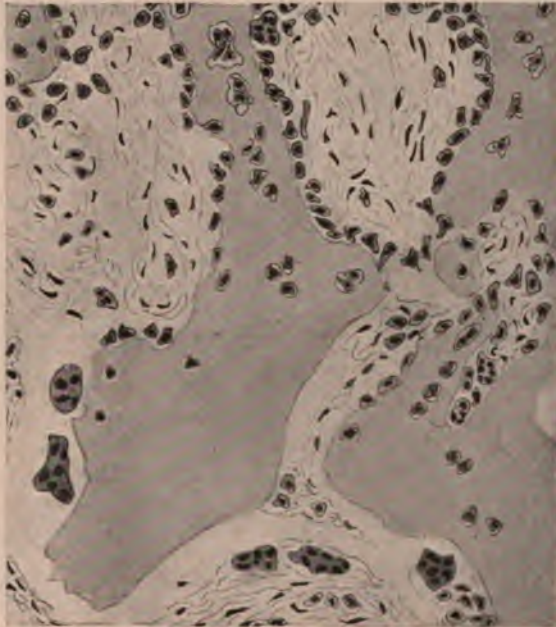


FIG. 84.—MICROSCOPICAL SECTION OF BONE IN NASAL POLYPUS. Showing early stages of Bone Disease.

commences in the periosteum, the deeper layer of which becomes thickened and converted into two or three layers of large cells. The bone in contact with this thickened periosteum becomes more cellular, apparently from increased size and number of the bone cells. Soon the edge of the bone becomes roughened, little bays or cup-shaped depressions are formed, and are filled with large cells, having one, two, or more nuclei. These cells are undoubtedly osteoclasts, and seem to eat their way gradually into the bone, forming large indentations along its edges. As the process advances, the bone becomes infiltrated with cells and breaks up, and frequently quite tiny fragments—mere microscopic spicules of bone—may be seen surrounded by large multinucleated cells. These appearances indicate a definite rarefying osteitis, which proceeds until the bone becomes disintegrated, breaks up into small fragments, and ultimately becomes absorbed. The

soft parts surrounding the bone show the changes commonly met with in chronic inflammation. In places there are large areas of fibrous tissue, part of which may have undergone myxomatous degeneration; in other places there is young fibrous tissue, and in others diffuse round-celled infiltration. The fibrous tissue forms a loose network, its meshes being distended with serous exudation. The vessels have greatly thickened walls, and are often surrounded by masses of round cells. The mucous glands are surrounded

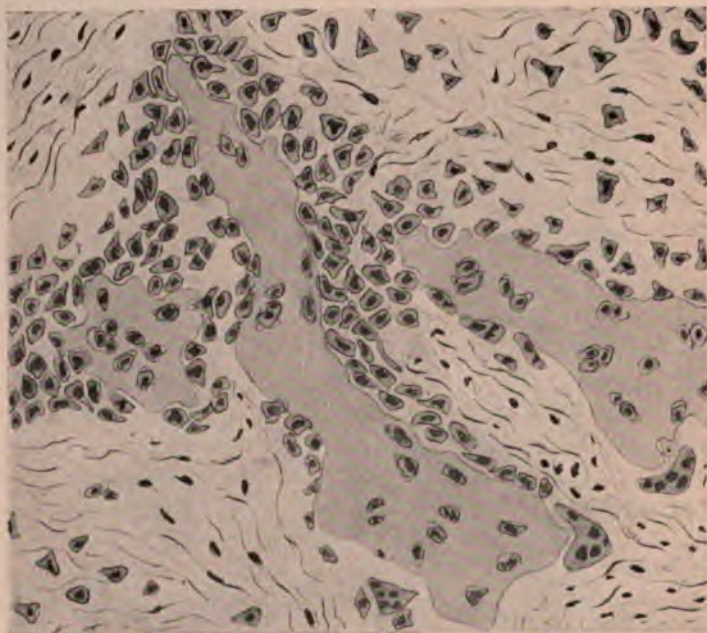


FIG. 85.—MICROSCOPICAL SECTION OF BONE IN NASAL POLYPUS. Showing late stages of Bone Disease. Detached spicules of bone are undergoing disintegration and absorption.

by similar cells, and in places their acini are dilated and the epithelium degenerating.

In a few specimens, in which a single polypus of old standing was removed from the nose, together with a piece of the underlying bone, another change was noted. The bone was very dense and difficult to divide with the snare, and on microscopic section it appeared thicker and denser than normal, but there was often no evidence of active osteitis. This suggests that osteitis had occurred, and had passed off, leaving a sclerosis of the bone.

Clinical Evidence. Thus, microscopic examination shows that changes in the bone are a constant accompaniment of nasal polypi, and clinical evidence of this association may also be obtained. The most reliable method is digital examination of the nose. When this was possible, that is, when a general anaesthetic had been given, the finger was pushed well

up into the ethmoidal region where it impinged upon soft jelly-like tissue in which spicules or loose pieces of bone could be plainly felt. It is rare to feel actually bare pieces of bone unless some operation has already been performed. Bone disease may often be detected with the probe, but very great care is necessary in using this instrument before drawing deductions from it. An easily bent probe with a blunt end should be employed, and no force whatever must be used. By carefully insinuating such a probe in various directions loose fragments of bone, which may feel distinctly bare and roughened, may be detected. Even by this method of using a probe the delicate, softened, infiltrated mucous membrane may be perforated, as is shown by the bleeding often produced, and a deceptive feeling of bare bone may thus be obtained.

Further evidence can be obtained in severe cases of nasal polypus in which no operation has been performed. If the growths are removed with the snare without touching the bone it may be found that the middle turbinate bone has entirely disappeared, and that the upper part of the nose is filled with masses of small polypoid growths.

Although the majority of my cases in which the bone has been examined have been instances of advanced disease, there is evidence that similar changes are found in connection with the simplest cases of polypi. Occasionally a single growth springing from the edge of the middle turbinate has been removed with part of the underlying bone, and on microscopic examination changes in the bone have been found exactly similar to those above described. Clinical evidence is also obtainable. Thus in one patient a single polypus had been twice removed from the posterior end of the middle turbinate. Some two years after the last operation the patient suffered from severe neuralgic pains with a feeling of obstruction and of great discomfort in the nose. On careful examination no polypus was found, but there was considerable bony enlargement of the posterior end of the middle turbinate. This part was extremely sensitive when touched with the probe, and the examination gave rise to an attack of neuralgia. A piece of the hypertrophied bone removed with a snare was found to be very hard and dense. Thus it seemed probable that an osteitis had preceded and caused the polypus, and that it had subsequently led to sclerosis of the bone. I have obtained clinical and pathological evidences of sclerosis of the bone in other cases. It probably indicates that the active cause of the inflammation has passed away, and that natural recovery has taken place. This condition of the bone will probably be found in those cases of nasal polypus in which no recurrence follows simple removal with a snare.

Polypi are occasionally found in the accessory cavities of the nose usually in connection with suppuration. In my experience they are rather rare. I have never examined the bone microscopically, but clinically it often presents gross signs of disease. In three cases in which I have found the maxillary antrum distended with polypi, large perforations have

existed in the bony walls of the sinus. In one case there was no supuration, but the antrum walls were bulging.¹ Goldsmith² records a similar case in which a large polypus was present on the inner wall of the antrum, and in which both the outer and posterior walls of the antrum were perforated.

Aetiology. The aetiology of nasal polypus has led to great dispute, and surgeons are not yet agreed on it. This was well shown at the meeting of the British Medical Association in London in 1895, and in the discussion at the Laryngological Society of London in 1900 the general opinion seemed to be that the cause must still be considered undetermined, all existing theories having serious, if not fatal objections. The more important theories, namely (1) that polypi are true tumours; (2) that they are peculiarly modified granulations; (3) that they are a symptom of sinus suppuration; and (4) that they are a symptom of bone disease, may now be discussed in the light of the above observations.

1. That Polypi are True Tumours. This was the view of the older surgeons, who regarded polypi as myxomata, soft fibromata or degenerated adenomata (Billroth), and it is still held by some.³ The facts that polypi are commonly multiple and recur rapidly after removal, yet are certainly not malignant growths; that they contain all the structures of the normal mucous membrane and pass at their edges imperceptibly into it; that they are often sessile, and that both macro- and microscopically they may be indistinguishable from localised oedema of the mucous membrane, show conclusively that polypi cannot be regarded as tumours in the strict sense of the term.

On the other hand, the histological appearances above described (p. 177) are quite compatible with the theory that polypi are the products of inflammation. In some cases they are suggestive of an acute inflammatory oedema or infiltration, in others of a more passive oedema such as results from lymphatic obstruction.

2. That Polypi are Modified Granulations. This brings us to the second view, that polypi are essentially granulations modified by the peculiar position or the conditions under which they grow, and that they may result from any form of irritation of the nasal mucosa (Macdonald and others). Polypi have been ascribed to the irritation of a rhinolith or a foreign body, to rhinitis caseosa, to syphilis, etc. But these causes are rarely present in nasal polypus, and, on the other hand, the growths usually seen under these conditions differ in many important respects from the ordinary nasal polypus. They have much greater resemblances to ordinary exuberant granulations. They are pink, bleed readily, consist of new-formed fibrous tissue, spindle and round cells, with numerous capillary loops;

¹ *Proc. Laryngol. Soc. of London*, 1900-1, viii. p. 21.

² *Journal of Laryngol.*, 1903, xviii. p. 625.

³ See W. G. Spencer, *Proceedings of Laryngological Society of London*, 1900-01, viii. p. 30.

they are more dense in structure and less oedematous than polypi: whereas nasal polypi contain all the elements of the normal mucous membrane, glands, nerves, vessels, and epithelium, and such highly specialised tissues are not found in granulations. Again, if a rhinolith or foreign body be present and be removed with the growths, the latter show no tendency to recur; in fact it is quite common for them to disappear spontaneously after removal of the source of irritation. The granulations occasionally seen after operations in the nose, as for instance when pieces of bone have been removed from the septum, or when part of the middle turbinate has been excised, are like granulations elsewhere, a little more exuberant perhaps, but quite distinct from the ordinary polypus. The theory, therefore, that a nasal polypus is an ordinary granulation peculiarly modified by the physical conditions under which it exists is not in accordance with facts.

3. **That Polypi are invariably a Symptom of Suppuration in the Accessory Sinuses of the Nose.** This theory has been warmly advocated by Grünwald, whose opinions have received much support.¹ The regions of the nose in which polypi originate are just those which would be most often exposed to the irritation of pus flowing from the sinuses. Polypi are often found in the sinuses themselves in connection with suppuration within them, and it is a common clinical experience that polypi lose their tendency to recur, or recur less frequently after a suppurating sinus has been treated.² Moreover, as means of exact diagnosis have improved, the frequency with which sinus suppuration has been found in association with polypi has increased. This theory, however, has the fatal objection that sinus suppuration, even with the latest and most improved means of diagnosis, cannot be demonstrated in anything like every case of polypus. Grünwald states that sinus suppuration was found in 82% of his cases, but other observers have found suppuration in only about one third (see page 179).

Polypi are most common in suppuration of the ethmoidal cells and frontal sinus, and much less common in suppuration of the maxillary antrum, even when of old standing. This is not quite what one would expect if sinus suppuration were the cause of polypi, but it is easily explicable on the theory of bone disease; for suppuration in the frontal sinus and ethmoidal cells is caused by severe infections, which at the same time would be likely to cause osteitis in the ethmoidal region, whilst suppuration in the antrum may arise from dental causes. Nasal polypi are, indeed, quite the exception in antral suppuration of dental origin. Finally, the cure of a suppurating sinus does not of necessity prevent the recurrence of nasal polypi. Probably it only does so when the cure has

¹ StClair Thomson in a recent review of the whole subject sums up in favour of this theory. *Practitioner*, 1904, lxxii. p. 275.

² Robertson, *Lancet*, 1893, i. p. 983, and Fink, *Archiv für Laryngol.*, 1894, i. p. 198, both advocated opening and draining the maxillary antrum in cases of recurrent nasal polypus.

been accompanied by extensive removal of bone from the ethmoidal region.

4. Lastly remains Woakes's theory, **that polypus is merely a symptom of disease of the ethmoid bone.** The pathological evidence has already been discussed, and it has been shown that bone disease is a constant feature of nasal polypus. Woakes's views have hitherto been generally discredited, partly because of his eccentric nomenclature, and partly because of the clinical inaccuracies in his original communications. Martin also subsequently repudiated any knowledge of the existence of a "necrosing ethmoiditis." Rhinologists objected to the use of Woakes's fine probe, which undoubtedly gives unreliable results. The thin muco-periosteum of the ethmoid, and even the brittle bony walls of the air cells, may be easily perforated by it. The fact, however, remains that rarefying osteitis of the underlying bone can be found microscopically in almost every case of nasal polypus.¹

The question remains whether the bone disease must be looked upon as the result of the polypus, as is often stated without any adequate reasons being assigned, or whether the osteitis is the cause of the polypus. This question I think can only be determined by the results of operation. That the ordinary method of removing polypi is followed by recurrence in the majority of cases is notorious. Of course simple removal is occasionally sufficient to effect a cure, or to give so long a period of relief that recurrence might be regarded as a fresh development of the disease. But this is not common, and operators of experience will at the most feel able to tell their patients that if the nose be kept clear of polypi, the tendency for them to recur may in time die out. If recurrence depends upon the presence of diseased bone, removal of the latter should at once destroy this tendency and effect a cure. Many of the older surgeons, as already seen, considered that it was a very good thing if pieces of bone were brought away. Still, so far as I am aware, it has never been recommended that the bone should be thoroughly and systematically removed in all the severer cases of polypi. The method shortly to be described, in which as much of the diseased bone as possible is removed, has now been practised for over eight years, and in the worst cases of nasal polypi, in which frequent recurrence has followed simple removal, it has commonly proved a complete success.

These facts seem to prove that nasal polypus is essentially a symptom of bone disease of the nature of rarefying osteitis, and that the tendency to recurrence depends entirely upon the persistence of the bone affection. *Polypi, in fact, may be regarded as circumscribed oedematous infiltrations of*

¹ That Martin found bone disease in only twelve out of twenty specimens supplied to him by Woakes may perhaps be accounted for by the fact that every specimen handed him was not obtained from a case of nasal polypus. Woakes believed that a large number of other nasal affections, such as ozaena and hay fever, were also dependent upon necrosing ethmoiditis.

the nasal mucous membrane, the result of osteitis in the underlying bone. They grow only from the ethmoid bone, which is covered by thin muco-periosteum, and never take their origin from the inferior turbinate or lower part of the septum. The ill development of the ethmoid in children is probably responsible for the rarity of polypus in early age.

Soon after my results were published, Cordes recorded some careful investigations. He concludes that polypus is essentially an inflammatory serous exudation and that, whilst in the milder cases the changes are limited to the mucous membrane or to the muco-periosteum, in all the more severe recurrent cases bone disease, either proliferative periostitis or hyperplastic osteitis, is present. Cholewa has also come to the conclusion that rarefying osteitis is the cause of polypus, and in the discussion at the Laryngological Society of London, Parker, Waggett, Tilley and others practically accepted this theory. Yonge, who also agreed, has recorded a recent case in which no active bone disease was found. It may be remarked that Yonge's specimens were obtained from the post-mortem room, as were also Zuckerkandl's. The results obtained from such material, in the absence of all clinical data or of rhinoscopic examination during life, are open to criticism. Zuckerkandl states that polypus is found in no less than one in nine subjects examined post-mortem. This is in such striking contrast with the rarity of the disease in the living that it opens up grave doubt if the cases described as polypus upon post-mortem evidence alone can be accepted as such, and it is no wonder if, in these circumstances, the bone is occasionally found to be healthy. Payson Clarke of Boston has recorded 147 cases of nasal polypi, and states that when the growths are numerous the middle turbinate will usually be found profoundly disorganised, but he does not regard ethmoid disease as the only cause of polypus. Packard describes six cases in all of which he is convinced that the polypi were the result of bone disease, whilst Jacques of Nancy believes that polypus results from the irritation of pathological secretions of all kinds in the nose. Thus a perusal of current literature shows that the views which, when enunciated by Woakes, aroused great and unreasonable opposition from practically all contemporary authorities, are now becoming generally accepted.¹

Whilst, then, I hold the above views as to the aetiology of every case of true nasal polypus, it is quite possible, indeed it is *prima facie* probable, that swellings very similar to polypi may be found in the nose without bone disease. Grünwald, by tightly packing the antrum, produced oedema of the lower lip of the ostium maxillare, which was indistinguishable from a polypus, both on clinical and microscopical examination; and similarly oedema of the mucous membrane occurring in connection with malignant disease of the nose is essentially similar to nasal polypus. That in such cases oedema of the nasal mucosa should form a growth almost if not

¹ StClair Thomson, *Practitioner*, 1904, lxxii. p. 275.

quite identical with a polypus is the strongest corroborative evidence of the views I have expressed.

Aetiology of Ethmoidal Osteitis. The pathological changes of osteitis and periostitis of the ethmoid have already been described: the cause is still unknown. In the majority of cases it is neither syphilis, tubercle nor trauma. It is probably the result of a severe acute or chronic rhinitis. It is occasionally ascribed to scarlet fever, diphtheria, or erysipelas; influenza is apparently a fruitful source and the cause of the increased frequency of the affection in recent years. It must be borne in mind that the mucous membrane of the upper part of the nose is intimately blended with the periosteum and almost forms one structure, a muco-periosteum. An acute inflammation of this region, therefore, may easily involve the periosteum and bones. It is quite probable that ethmoiditis may also be due to sinus suppuration. Caries may be found in the walls of a sinus as the result of suppuration, and it is also possible that pus flowing from a sinus into the nose may excite deep-seated inflammation in the parts with which it constantly comes in contact. Thus, ethmoidal cell suppuration may be a primary cause of the affection, and even if no pus be seen when the patient comes under observation, it is possible that the suppuration might have passed off after the cells were opened by the carious process. Of course, it may quite well be that the same cause has given rise to both sinus suppuration and bone disease, but I believe the former may be primary and give rise to the latter. Still, it is curious to note how rarely nasal polypi are seen in connection with antral suppuration of dental origin. Frequently, no pus is seen in the nose, and probably has never been present, for bone disease, and especially the form now under consideration, often occurs without suppuration; in fact, pus is only present when, in addition to the original cause, pyogenic organisms have gained admission.

The clinical history of a nasal polypus and the various stages of the bone disease may be best observed in the middle turbinate, although it must be borne in mind that this structure is by no means the most frequently affected part. In the early stages of periostitis and commencing osteitis, the mucous membrane overlying the affected part becomes thickened and oedematous, and the middle turbinate appears to be enlarged and rounded. Sections of the bone and of the soft parts overlying it exhibit the early stages of bone disease as above described, and the mucous membrane shows the appearances ordinarily seen in nasal polypus.

The inflammatory thickening of the bone and other tissues of the middle turbinate may give rise to the distension of a cell which normally exists in its anterior extremity. The tiny duct of this cell becomes blocked; mucous secretion accumulates in and distends the cavity until it may almost fill the middle meatus, or even extend into the inferior. Occasionally the lower wall of this cyst may give way, and lead to the formation of a cleft in the middle turbinate. From the cleft polypi may project, and if a probe

be passed into it, bare and perhaps roughened bone may be detected. Woakes described this as the usual progress of the disease, but it is in reality rare. The appearance of "cleavage of the middle turbinate" is not uncommon, but it is due to swelling and oedema of the outer wall of the nose in the region of the uncinate process, which comes into contact with the middle turbinate, and the polypi which project through this cleft really spring from the middle meatus.

As the rarefying osteitis slowly spreads through the ethmoidal region, it leads to obliteration of all the normal outlines of the parts and to extensive disintegration of the bone. It is accompanied by extensive degeneration and oedematous infiltration of the mucous membrane. This is the final stage of the disease, which is a slowly progressive erosion and molecular disintegration and absorption of the bone. The stage of necrosis which Woakes describes, and from which he names the disease, is, I believe, an error. Apart from syphilis and such affections, actual necrosis with the formation of a sequestrum is unknown.

It is probable that, at any of the earlier stages, the disease may become arrested, that repair may take place and lead to sclerosis and thickening of the bone. A spontaneous cure in the later stages, even if it occurs, is extremely rare.

Woakes deserves the credit of having been the first to suggest that bone disease was the cause of polypus. His views might have gained more rapid acceptance if he had avoided some clinical errors, and especially if he had avoided the term "necrosing," which is obviously inapplicable to an affection in which true necrosis never occurs. Also the use of the sharp probe led Woakes into the error of believing that ethmoiditis was extremely common, and was the cause of such various affections as hay fever, ozaena, etc.

Symptoms. The symptoms may be divided into the local and the remote. There is more or less nasal obstruction, the voice acquires a "nasal" character, and the patient resorts to mouth breathing, with its concomitant ill effects on the upper air passages. The nasal secretion is usually excessive; sometimes it is profuse and watery; at others purulent or muco-purulent. The sense of smell and appreciation of flavours is lost. Eustachian obstruction and middle-ear catarrh may also be met with. Occasionally patients may feel a loose growth flapping about in the nose, or may be able to protrude it from the anterior nares. In more severe cases there may be widening of the bridge of the nose, due to venous congestion of the soft parts, or to outward displacement of the nasal bones.

Amongst the remote symptoms may be noted asthma, severe neuralgia, sweating of the head, cough, hay fever, epileptiform attacks, giddiness, nightmare, and other reflex phenomena of nasal obstruction (see Chap. IV.). The subjects of this affection may also exhibit, sometimes in a marked degree, the condition of mental dulness and apathy known as aprosexia.

Diagnosis. Typical nasal polypi—smooth, globular, glistening, translucent, pedunculated tumours with a bluish or pinkish tinge—can hardly be confused with anything else. They spring from the middle meatus or upper part of the nose, and thus should easily be distinguished from hypertrophy of the anterior extremity of the inferior turbinate or from septal tumours. From hypertrophy of the posterior extremity of the inferior turbinate they are distinguished by their colour, situation, and attachment. Moreover, turbinal hypertrophies are usually moriform. Care may be required in making a diagnosis from malignant disease, tubercle, syphilis, cystic disease of the middle turbinate, and meningocele. The distinction between polypi and granulations has already been pointed out (page 184).

Malignant disease may be detected by attention to the character of the growth, which is usually harder in consistence, more fixed, with a rough, ulcerated, bleeding, discoloured surface and an extensive attachment. Frequent and profuse epistaxis is an early and constant symptom, and the growth readily bleeds on being touched. It may grow from any region of the nose. If any doubt exists, it is better to remove a piece for microscopical examination, and thus at once to determine the nature of the growth. It must be borne in mind that nasal polypi are often associated with malignant disease, and until they are removed the actual malignant tumour may not come into view. This fact probably accounts for the statement often seen in text-books, that ordinary nasal polypi may undergo malignant transformation—an occurrence which has never been thoroughly authenticated (see Chap. XIII.).

Tubercular tumours are small, pale, irregular, fleshy-looking growths, covered with purulent secretion, often ulcerated and readily bleeding on being touched. They are most common in the anterior region of the nose on the septum or inferior turbinate, and may lead to deep though slow destruction. When necessary the diagnosis may be completed by microscopical examination.

Syphilis is a much more acute process, and rarely gives rise to a polypoid mass, but commonly to red, vascular granulations and acute oedema of the mucous membrane, behind which a deep, sloughy ulcer or a sequestrum may be found. It is accompanied by profuse purulent, foetid secretion; the diagnosis is clinched by the discovery of a sequestrum or by the results of treatment.

A cyst of the middle turbinate may look exactly like a nasal polypus, and, being due to the same causes, may be associated with them. The bony cyst can easily be recognised by the probe, being hard and fixed, although covered by oedematous or polypoid mucous membrane. If the probe be not used, the diagnosis may not be made until the cyst is removed with the snare—a matter which is of no consequence.

Meningocele is very rarely met with in the nose, but it is extremely important to recognise it, as a fatal result might follow an attempt to remove it with a snare. Instances of these rare cases have been recorded

by Meyer,¹ by Fender,² and a doubtful one by Pegler.³ If suspected, they might be recognised by their history, and by the facts that they spring from the roof of the nose, and that owing to their congenital origin and long duration there is usually extensive deformity of the external nose and of the nasal septum. It is also said that in some cases the tumour pulsates and moves on respiration.

Treatment. Bearing in mind the pathology of the affection, it is obvious that the treatment of polypus cannot be disassociated from that of the disease in the bone. It is convenient to recognise four groups of cases.

1. **Polypi without Active Bone Disease.** When one or two polypi only are present, which are pedunculated and of long standing, in which there is no sign of active disease present, and in which, therefore, it is



FIG. 86.—BLAKE'S NASAL SNARE.

probable that the initial bone disease has completely passed off, or has led to sclerosis, simple removal with the snare may be practised. It is a matter of everyday experience that recurrence in these circumstances is rare. The interior of the nose, and especially the immediate field of operation, should be anaesthetised with cocaine and supra-renal extract. A bright light is reflected into the nose, the loop of the snare is guided round the polypus and pushed up as close to the attachment of the growth as possible. The wire is then tightened and the growth removed either by cutting through its attachment or by a gentle pulling and twisting movement. Where it is desired to save the patient as much pain as possible, the pedicle should be cut through; but when slight pain is easily borne, it is better to tighten the wire sufficiently to obtain a firm grasp, and then to pull the growth away. By this means a piece of surrounding mucous membrane or even another polypus is often removed.

¹Virchow's *Archiv*, 1890, cxx. p. 309.

²*Amer. Journ. Med. Sci.*, 1895, vol. i. p. 1.

³*Proc. Laryngol. Soc. of London*, 1902, ix. p. 103, and *Journ. of Laryngol.*, 1902, xvii. p. 363.

The best snare is a simple one such as Blake's (Fig. 86). Mackenzie's (Fig. 87), excellent in many ways, makes a disagreeable clicking noise; moreover it is a complicated instrument, difficult to cleanse or sterilize. It only acts well with a thin wire, which is damaged after being used once or twice, and is tiresome to replace. Krause's snare (Fig. 88), or my own with its slender shaft attached, may also be used. When there is any difficulty



FIG. 87.—MACKENZIE'S NASAL SNARE. (Modified by Hovell.)

in getting the snare round the growth, the latter may be drawn forwards and fixed by a small hook such as Baber's, or by forceps, and the wire loop passed over the instrument. If a polypus hangs down into the post-nasal space, an attempt should be made to pass the loop of the snare round it from the front aided by the hook or forceps as above directed,



FIG. 88.—KRAUSE'S NASAL SNARE.

but it may be necessary to pass the index finger of the left hand up into the naso-pharynx and with it to guide the loop over the growth as was recommended for the removal of enlarged turbinal extremities (Fig. 73).

When a very large polypus fills the nose and projects into the naso-pharynx, the following manœuvre may be practised: a snare is threaded with comparatively stiff wire, the free ends of which are left unattached, and a small loop only is allowed to project from the barrel. This small stiff loop is pushed through the nose into the post-nasal space, until it

can be felt with the finger. The tip of the finger is hooked into the loop, which is drawn through the post-nasal space into the mouth, widely opened and then slipped back over the growth. The wire loop is now pulled up as tight as possible around the pedicle of the polypus, its free ends are made fast to the snare in the usual way and the growth cut through. For this operation a general anaesthetic may be necessary.

For most cases the snare alone is sufficient, and it is the least dangerous and least painful instrument to use. Occasionally, however, for post-nasal polypi, and when working under general anaesthesia, the polypus forceps are useful, as they can be forced down the nose however much it be obstructed, and they are more easily felt and adjusted round the pedicle of a growth with the finger. As a routine instrument they have long since been superseded by the more delicate snare. The use of the galvano-cautery snare has also been generally abandoned. Its supposed advantage, that by searing the base of the polypus it prevented recurrence, is a fallacy. The irritation and inflammation set up by the burning is more likely to lead to extension of the bone disease and to recurrence of the growths.

After-Treatment. One or more growths should be removed at each sitting, and intervals of a week or ten days should always be allowed to elapse between each operation on the same nostril. Occasionally sharp haemorrhage follows the removal of a polypus; should it be serious it may be stopped by lightly packing the bleeding spot. A small pledget of wool should be worn in the nostril for at least twelve hours after the operation. When all bleeding has ceased, the nose should be gently syringed with a mild antiseptic solution, or a simple alkaline nasal wash may be given.

Prognosis. In these simple cases removal with the snare generally brings about a permanent cure. The patient should be seen from time to time at first at intervals of a month and subsequently once or twice a year so that any recurrence may be at once treated. Should there be evidence of bone disease or sinus suppuration a thorough examination and diagnosis must be made and further treatment adopted. The longer the duration of the disease and the fewer the growths the better the prognosis.

2. Enlargement or Cystic Disease of the Middle Turbinate. The affected part should be removed, and this generally resolves itself into a typical amputation of the anterior end or more of the middle turbinate. The method of performing this little operation is well shown in Fig. 90. A deep notch is made in the free lower border of the middle turbinate behind the part to be removed, with Grünwald's or other cutting forceps: the operation is completed with a snare threaded with fairly thick wire. The loop is slipped into the notch, and the tip of the snare is pressed up against the highest part of the anterior border of the bone whilst the wire is slowly tightened, and the bone cut through. No special after-

treatment, beyond the use of a simple alkaline wash for a few days, is required. The results of this little operation are excellent, and in suitable cases the whole disease may be removed.

3. **Early Polypus with limited Bone Disease.** When a few polypi only are present, with a limited area of bone disease, the snare may be used as above described, but an attempt should be made to hitch up the wire loop as high as possible around the base of the growth, and to encircle the piece of bone from which it grows. After the polypi have been removed, at a subsequent sitting the affected region should be thoroughly anaesthetized and the underlying bony parts clipped away with Grünwald's forceps. Hajek's hook is often a very useful aid in doing this. The anterior end or more of the middle turbinate may be removed to give access to the affected region. Should this plan not be practicable, or



FIG. 89.—GRÜNWARD'S PUNCH FORCEPS.

should there be recurrence, it is best to give a general anaesthetic such as nitrous oxide, and to scrape the affected part with a ring knife under good illumination. By this means the whole of the affected bone may be removed without danger, and a good result will follow. No after-treatment beyond the use of a nasal wash is required.

4. **Polypus with Extensive Bone Disease.** While the above methods are successful in the simpler cases of polypi, they are utterly inefficient to cope with extensive and advanced disease. When extensive disease is present, when rapid or repeated recurrence has followed previous treatment, and especially when polypi are associated with suppuration in the ethmoidal cells or other sinuses, I recommend a far more thorough and radical operation. In these cases simple removal of polypi is useless, and I believe it is better to give a general anaesthetic and to remove not only the polypi, but the whole of the affected part of the ethmoid bone. When sinus suppuration is present this operation is a great help in diagnosis and treatment, as will appear later. If the operation be thoroughly performed and the ethmoidal region cleared out, suppuration in the frontal sinus or in the sphenoidal sinus, if present, can be at once recognised by

mere inspection of the nose. Further, and this illustrates the dependence of polypi upon bone disease and not upon suppuration, I have had

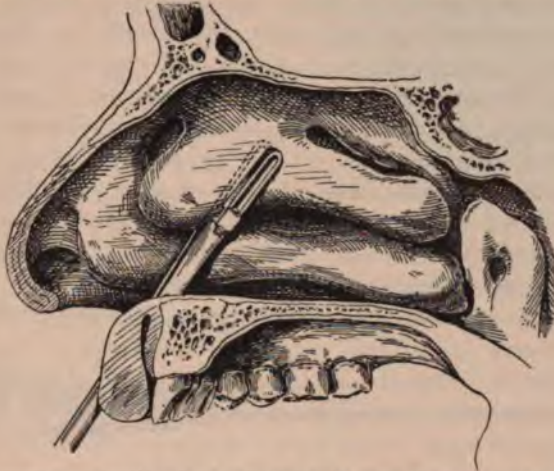


FIG. 90.—AMPUTATION OF ANTERIOR END OF MIDDLE TURBINATE. First stage.

numerous cases in which the formation of polypi ceased immediately after the curetting of the ethmoid, although previously recurrence had been frequent and although suppuration in the frontal and the sphenoidal sinuses was allowed to continue.



FIG. 91.—AMPUTATION OF ANTERIOR END OF MIDDLE TURBINATE. Second stage.

The **operation** is performed as follows :—The patient being anaesthetized, the ethmoidal region should be thoroughly examined with the finger, both through the nose and through the post-nasal space, to determine as far

as possible the extent of the disease. Any specially large growths may be removed with polypus forceps, and the middle turbinate, if present, brought away with the spokeshave. Then the ethmoidal region should be thoroughly scraped with a large ring knife such as Meyer's original adenoid curette. This is the most effective instrument; sharp spoons are quite useless. The instrument is passed back into the nose, its sharp edge directed outwards towards the orbit, and the whole lateral part of the ethmoid rapidly scraped away. Large masses of polypi, degenerated mucous membrane, and fragments of bone are removed. The scraping is continued until all friable tissue has been brought away: when healthy bone is reached, it is readily distinguished by its smoothness, firm resistance, and the little hold it gives to the knife. Of course great caution must be used and the sharp edge of the knife should never be



FIG. 92.—MEYER'S RING CURETTE.

turned in the direction of the cribriform plate: if the inner wall of the orbit be broken or scraped away, little harm will result. I prefer to operate with the patient in the recumbent position, or turned over on to his side. Others prefer the patient sitting up in the ordinary rhinoscopic position. They state that in this position, by frequently mopping the nose, a view of the field of operation may be obtained, and that the surgeon can see exactly what he is doing. The bleeding, however, constantly obscures the view, and probably a better idea can be obtained of what is actually being done by carefully noting the position of the patient, by bearing in mind the anatomical relationship of the parts, and by the feel of the knife. The enormous amount of disease that is often removed affords in itself one of the strongest arguments of the necessity for this operation. As Parker has pointed out, if, in a severe case of nasal polypi, all the large visible growths be first removed and then the patient be submitted to this operation, the amount of degenerated tissue that comes away is almost incredible and shows the utter futility of snare operations.

Immediately the operation is finished the patient should be turned quite over on to his side and cold water applied to the face to arrest the haemorrhage. The bleeding is usually profuse, but soon stops. Should it continue, the nose should be rapidly packed with strips of gauze. For this purpose the finger should be inserted in the post-nasal space and the gauze passed back to it through the nose by means of forceps, until the whole nose is tightly packed. The gauze may be removed on the second day, and should not be replaced. The objections to packing the nose are that it causes considerable discomfort to the patient, that its subsequent removal may lead to renewed haemorrhage, that it retains the secretions, and is

liable to set up irritation in the nose and septic disturbances, especially when sinus suppuration is present.

In my earlier cases, in which packing was always used, febrile disturbance for a few days after the operation was frequently noticed. Since I have abandoned the packing a rise of temperature has become a rare event.

After-Treatment. The best after-treatment consists in doing as little as possible. After the first 24 or 48 hours, the nose may be gently irrigated with a mild antiseptic solution. For the first week or two after the operation, exuberant oedematous granulations may be seen in the upper part of the nose, but it is astonishing how little inconvenience the patient experiences from them. Although they may seem to fill the upper part of the nose the patient will state that the nose feels perfectly clear. If left alone they disappear spontaneously, but occasionally a semi-detached tag of mucous membrane or bone may have to be removed. Usually complete healing is obtained in about two months; a large dry cavity forms in the upper part of the nose, lined by thin, pale mucous membrane. Recurrence is very rare in simple cases, but is more common when the disease is associated with sinus suppuration, especially when the latter is left untreated.

III Results. In a few cases there was a sharp *rise of temperature* to 103° to 104°F., but it subsided in 24 or 48 hours, and was not attended by serious trouble. I believe it was usually due to packing the nose with gauze, which, by preventing the free escape of pus, promoted septic absorption. *Headache* has been rare, and usually temporary; it might have been due to the anaesthetic. Suppurative *otitis media* has occurred in a small percentage of cases, but only when the patient had previously suffered from the same disease. Occasionally *adhesions* have formed between the outer wall of the nose and the septum, sometimes mere strands which could easily be divided by the galvano-cautery, at other times more extensive. They may have resulted from acute inflammation following the operation, but in all probability were chiefly due to simultaneous injury to the septum. If care be taken to avoid this they probably need not occur. In only one case has a serious complication followed: three weeks after an operation for nasal polypi with extensive suppuration in the ethmoidal cells, and probably also in the frontal sinus, and ten days after the patient had left the hospital, apparently well, he returned with an *orbital abscess* accompanied by necrosis of a portion of the inner wall of the orbit. This might have arisen apart from the operation, but was probably caused, or at any rate hastened, by it. The abscess was incised: later on a sequestrum was removed, and the patient did well.

So far as I am aware, only one *death* has been reported from this operation, and on this patient three or four operations were performed within a few months.¹ Such repeated small operations are more dangerous than the single extensive complete one I have advocated.

¹ *Vide* Bronner, *Proc. Laryngol. Soc. of London*, 1902-3, x. p. 48.

I also know of two unreported deaths, in one of which the cribriform plate was fractured by scraping, and in the other was perforated by the polypus forceps. These unfortunate fatalities show the necessity for care in performing the operation, and especially emphasise the absolute necessity of directing the instruments outwards towards the orbit and of never using any force in the direction of the cribriform plate. I have operated myself in over 150 cases during the past eight years without any grave complication. This experience seems to me sufficient to prove that the operation is both safe and efficient, and at the present time nothing has been recommended which could replace it.

The **results** as regards recurrence are extremely good. A permanent cure has resulted in the large majority in which snare operations had been repeatedly followed by recurrence. Even when associated with suppuration in the ethmoidal cells or other sinuses recurrence has been rare, and when it has occurred the disease has never been the intractable affection it was before the operation.

The only alternative,—repeated small operations, “nibbling away” with cutting forceps or hooks,—may perhaps effect a cure in time, but has many and great disadvantages. These little operations are always painful, as cocaine acts by no means satisfactorily in these cases. Ten, twenty, and even more sittings are often required, as very little can be done at a time. They are extremely tedious and discouraging to the patient, and the constant pain and dread cause general ill-health. Little or no benefit following the earlier operations, the patient often abandons treatment. When suppuration is present each operation exposes a raw surface over which the pus flows, and there is necessarily a tendency to septic absorption, and to the spread of the bone affection. Finally fatal results have occurred from meningeal affections apparently directly due to operation, and I believe these repeated timid procedures are more dangerous than a single severe but curative measure.

In conclusion, then, I would urge that this operation, carried out with due precaution, should be performed in all cases of nasal polypi in which there is extensive disease of the ethmoid bone, in which recurrence of polypi has repeatedly followed other methods of removal, and in which suppuration is present in the ethmoidal cells or other accessory cavities.

References.

- WOAKES. Brit. Med. Journ., 1885, i. p. 701.
 WOAKES. Brit. Med. Journ., 1892, i. p. 546; ii. p. 1362.
 WOAKES. Brit. Med. Journ., 1893, i. pp. 91, 1216.
 HAJEK. Archiv für Laryngol., 1896, iv. p. 277.
 HAJEK. Archiv für Laryngol., 1903, xiv. p. 489.
 ALEXANDER. Archiv für Laryngol., 1896, v. p. 324.
 OKADA. Archiv für Laryngol., 1898, vii. p. 204.

- CORDES. *Archiv für Laryngol.*, 1900, xi. p. 280.
 BAUMGARTEN. *Journ. of Laryngol.*, 1895, ix. p. 60.
 YONGE. *Journ. of Laryngol.*, 1904, xix. p. 455.
 KRONENBERG. *Therap. Monatschr.*, 1897, xi. p. 259.
 REICHERT. *Wien. klin. Rundschau*, 1897, xi. pp. 285, 307.
 LACK. Physician and Surgeon, July 12th and 19th, 1900.
 LACK. *Proc. Laryng. Soc. of London*, June, 1900, and *Journ. of Laryngol.*, 1900, xv. p. 380; *Proc. Laryng. Soc. of London*, 1900, Dec.; and *Journ. of Laryngol.*, 1901, xvi. p. 64.
 CHOLEWA. *Monatschr. für Ohrenheilk.*, 1900, xxxiv. p. 103.
 LUC, ZUCKERKANDL and Discussion. *Brit. Med. Assoc., Meeting in London*, August, 1895; *Brit. Med. Journ.*, 1895, ii. pp. 474-481.
 LUC. *Tribune Médicale*, 1905.

CHAPTER XII.

CHRONIC INFECTIVE DISEASES OF THE NOSE.

Syphilis. Tuberculosis. Lupus. Leprosy. Rhino-Scleroma. Glanders.

SYPHILIS.

EXTENSIVE destruction of the nose as the result of venereal disease was known and described in ancient times. Syphilis, acquired or inherited, may attack the nose at any stage, but tertiary lesions are by far the most common. They may occur from within a few months up to thirty years or more after the primary infection; but are most common in the first few years, and are often seen in spite of a prolonged course of mercurial treatment.

Primary Syphilis. Chancres in the nose are very rare, although several instances are on record. Thus Chapuis¹ has published an account of twenty-two cases. They are most frequent in the vestibule, but may occur on the mucous membrane, especially on the anterior part of the septum. They are usually caused by picking the nose with an infected finger, or by the use of infected instruments, such as a dirty Eustachian catheter. The symptoms are not characteristic. There is unilateral nasal obstruction with more or less sanious, purulent, often foetid, discharge. There may be neuralgia, headache, and mild constitutional disturbance. On examination a soft or hard ulcer, with a slightly raised edge may be seen; the base is covered with secretion, and bleeds readily if touched. The sub-maxillary glands on the affected side are generally enlarged and hard. Should a chancre occur in the posterior part of the nasal cavity, deafness and earache will probably be marked symptoms. The true nature of the lesion in this region will probably be unsuspected until secondary symptoms appear. The diagnosis is always difficult; but attention to the above points, together with the history, should excite suspicion. When secondary symptoms appear on the skin or in the throat the diagnosis is easy. The treatment and the prognosis are the same as for primary syphilis elsewhere.

¹ *Gaz. des Hôpitaux*, 1894, lxvii. p. 1103.

Secondary Syphilis. The manifestations of secondary syphilis in the nose are mild and often overlooked. They present nothing very characteristic. The earliest symptom is slight catarrh, with general redness and swelling of the mucous membrane. This coryza is more chronic and less severe than in ordinary "cold," and it is said that the redness may be patchy or of a deeper hue, but the diagnosis really depends upon the associated affections of the fauces and skin. In the later stages condylomata and eruptions, similar to those of the skin, have been described: they are extremely rare. More frequent are fissures round the nares and on the upper lip, and acne or sycosis-like nodules in the vestibule. The diagnosis depends upon the presence of the other constitutional manifestations of syphilis. General specific treatment is indicated; no special local measures are necessary.

TERTIARY SYPHILIS.

This is by far the most common and the most important manifestation of syphilis in the nose. It occurs most frequently from one to three years after the primary infection. The commonest form is a gummatous infiltration which soon softens and leads to a rapidly progressive ulceration of the mucous membrane, with destruction of the cartilages and bones. A gumma is rarely observed; it forms a firm, elastic, sharply circumscribed or diffuse swelling. As the interior of the gumma softens, the surrounding mucous membrane becomes oedematous, the surface gives way, and a small opening forms, through which the broken-down contents may discharge like an abscess. A purplish-red swelling on the septum or floor of the nose, with a fistulous opening near its centre, leading to bare cartilage or bone, is not uncommon. A diffuse infiltration usually leads to extensive superficial ulceration, which rapidly spreads deeper until the cartilage or bone is exposed. The bones or cartilages may also be primarily attacked. The skin, especially that of the alae and tip of the nose, may be affected. It becomes swollen, dark or bluish-red, and soon ulcerates: rapid and extensive destruction, or perforation of the alae, or of the septum, follow. Rarely the ulceration may take another form, spreading slowly, and more superficially, and healing in one place as it spreads in another. This gives rise to a lupus-like affection—the so-called "syphilitic lupus."

Symptoms. The earliest symptoms may resemble those of an ordinary cold, viz., increasing nasal obstruction, with more or less muco-purulent discharge. As the disease progresses, the discharge becomes more profuse and purulent, it is often blood-stained, and acquires an exceedingly foetid odour: the obstruction becomes complete. Later the discharge may assume the form of large foetid ozaena-like crusts, which are expelled with difficulty, or may pass down the throat: this indicates extensive destruction of the nasal mucous membrane. Neuralgic pains in the nose, radiating over the face and head, are common. If the skin or nasal bones

be affected, there is tenderness on pressure. There may be swelling of the nose or adjacent parts of the face, oedema of the eyelids and dermatitis around the anterior nares. A sequestrum may come away, or necrotic fragments of bone may be found in the discharge.

The appearances depend upon the situation and the stage of the disease. When the anterior part of the septum is involved, a small or large ulcer may be seen with characteristic sharp-cut edges and sloughy pus-covered floor. Soon the cartilage becomes bare, necroses, and



FIG. 93.—DEPRESSED BRIDGE OF NOSE RESULTING FROM TERTIARY SYPHILIS.

perforation of the septum takes place. The opening may be small and round, or large and irregular; its edges are thick and covered with granulations and crusts. When healing takes place, the base of the ulcer or edges of the perforation become covered with epithelium, usually squamous; for a long time crusty secretion collects and adheres to the healed surfaces. If extensive destruction of the septum in this region occurs, there is usually some falling in of the tip of the nose.

The bony septum is more frequently affected, and may present similar appearances to those above described, but there is apt to be swelling of the surrounding mucous membrane or exuberant granulations, which prevent a view of the actual ulcer. Even though a large perforation

occur, or almost the entire bony septum be destroyed, there will be no falling in of the bridge of the nose, unless the nasal bones are also attacked.

The nasal bones may be affected alone or more generally in combination with disease of the septum. The initial lesion is often a subperiosteal gumma. In the early stages it forms a firm elastic swelling over the bridge of the nose, but softening rapidly takes place, and the skin becomes red, swollen and oedematous. The broken-down gumma may burst externally or into the nose and an ulcer form with necrotic bone at its base.



FIG. 94.—"NEZ EN LORGNON" RESULTING FROM TERTIARY SYPHILIS.

The destruction of the nasal bones usually results in the formation of the well-known saddle-backed nose. In a typical case the bridge of the nose may be almost flat with the cheeks and covered with scarred firmly adherent skin: the tip of the nose is tilted and the nostrils look forward as well as downward (Fig. 93). More rarely the so-called *nez en lorgnon* is produced (Fig. 94). This probably results from cicatricial contraction pulling on the bridge of the nose at the junction of the cartilage with the nasal bones following extensive destruction of this part of the septum. When the nasal bones and septum are extensively affected at the same time, the bridge of the nose may lose all its supports and may sink in to such an extent that it seems to consist merely of three loose folds of skin with two small apertures in front representing the nostrils.

When the inferior turbinates are affected the ulceration is usually concealed by exuberant almost polypoid granulations, which render a view impossible even after the application of cocaine. Bare or necrotic bone may be detected with the probe and the whole turbinate may come away as a sequestrum. Both the turbinates and the septum may be simultaneously affected and the whole interior of the nose turned into one large suppurating cavity.

When the floor of the nose is involved there is usually a dark red diffuse swelling, in which a small discharging sinus may be detected. If a probe be passed into this opening bare bone can be felt. At the same time there is usually swelling and tenderness in the corresponding part of the roof of the mouth. This swelling may ulcerate and lead to a communication between the mouth and the nasal passages. Perforation of the palate causes marked alteration in the voice, which resembles that of a person with a cleft palate, and food, especially when fluid, tends to enter the nose in swallowing. The necrotic bone in this region has a great tendency to remain fixed for a long period.

When the ethmoidal or sphenoidal regions are attacked extensive necrosis may result and almost the entire bones may come away as sequestra. In the worst cases the whole interior of the nose and its accessory sinuses may be affected, the septum, the floor of the nose, the turbinates, destroyed, and the mouth and nasal cavity converted into one large chasm. When the upper part of the nose is affected a fatal termination is not unknown: venous thrombosis, cerebral abscess or meningitis may supervene.

Among the more common complications are involvement of the Eustachian tubes and ears, dacryo-cystitis and lachrymal obstruction, and suppuration in the accessory sinuses. The last complication is more rare than might be expected: the walls of the sinuses are often involved in ulceration or necrosis, but the large opening which results ensures thorough drainage.

A few words must be said about the ultimate results of syphilis. The saddle-backed nose, the *nez en lorgnon* and the other deformities due to the loss of the bony framework, have already been described. There may be extensive defects of the external skin, destruction of one or both alae, destruction of the columella and anterior part of the septum, which throws the two nostrils into one cavity and is generally associated with depression of the tip of the nose, or there may be irregular perforations of the septum. Cicatrisation of the anterior nares may lead to narrowing or even complete occlusion of one or both nostrils. Ulceration of the posterior part of the nose or post-nasal space may end in narrowing or occlusion of the posterior choanae or more commonly in adhesions between the posterior surface of the soft palate and the posterior wall of the pharynx. Synechia may form between the nasal septum and the outer wall of the nose. They may be broad and extensive or mere strands passing between the inferior turbinates and some prominence on the septum. Granulomata

are occasionally met with; they are not gummatous swellings but organised inflammatory growths. They may be small or large and resemble an ordinary nasal polypus, but are generally of a firmer consistence and a brighter red colour. They have little tendency to ulcerate and may show no sign of endarteritis, but can be recognised by the history, the associated symptoms and the result of treatment.

A condition resembling atrophy of the nasal mucous membrane always follows extensive ulceration. The mucous membrane with its glands, vascular sinuses, ciliated epithelium, etc., has been destroyed, and in its place is cicatricial tissue covered by squamous epithelium. Necrosis may have led to the loss, or rarefying osteitis to the shrinking, of the bones. The ultimate result is a condition very similar to ordinary ozaena, in fact the two affections may be pathologically and clinically indistinguishable (see page 165).

Diagnosis. The diagnosis as a rule is easy, but difficulties may occasionally arise. In doubtful cases the careful use of the probe may detect necrosed bone which is not apparent on inspection.

Lupus leads to much less rapid destruction, usually commences at an earlier age, rarely affects the bones, and is usually accompanied by typical nodules on the skin or in the throat. In doubtful cases the diagnosis may be settled by the result of administering iodide of potassium or by microscopical examination of a piece of the diseased tissue.

Leprosy and *rhino-scleroma*, both extremely rare affections in this country, may be recognised by the associated affections of the skin and the latter by the extreme hardness of the lesions. Syphilitic ulceration with profuse purulent discharge and exuberant granulations may closely resemble *sinus suppuration* with nasal polypi, but the history, the rapid destruction, and the detection of necrosis with the probe should clear up the diagnosis. The same remarks apply to a *foreign body* in the nose, associated with much discharge and profuse granulations. It must be borne in mind that a perforation of the cartilaginous septum is by no means characteristic of syphilis, probably less than 50% being due to this disease (see page 124).

Prognosis. When there is extensive destruction in the ethmoidal or sphenoidal regions the prognosis is grave, as there is a liability to septic thrombosis of the cavernous sinuses and to meningitis or cerebral abscess. When other parts of the nose are affected the prognosis is good as regards life, and the destruction and deformity can usually be arrested by proper treatment. It must be remembered that all cases of syphilis are not equally tractable: some require prolonged and most careful treatment before they will yield, and this applies especially to patients who are in poor general health, and to the aged and alcoholic. Some forms of syphilis, especially those rife in India and hot climates, appear very intractable.

Treatment. Both local and general measures are required. The **general treatment** consists in the administration of iodide of potassium

in large and increasing doses. This is usually successful, but when the patient does not respond to it a course of mercury should be tried. Mercurial inunctions have been very strongly advocated, and certainly they often succeed when iodides fail. In the most intractable cases when this treatment alone is unsuccessful, my own experience is that success can be obtained by careful general treatment of the patient. I am accustomed to keep such patients entirely in bed, to give them a light and nutritious diet consisting mainly of milk, to forbid all alcohol, and to administer the iodide in large doses (two to four drachms daily). After a month or at most six weeks' treatment, the iodide should be omitted and a mixture of perchloride of mercury with perchloride of iron prescribed. After healing has taken place patients who can afford it may advantageously undergo an antisyphilitic cure at a foreign health resort such as Aix-la-Chapelle.

Local Treatment. The nose should be cleansed three or four times daily with a mild antiseptic or alkaline lotion. Exuberant granulations should, if necessary, be touched with chromic acid or other caustic: the use of the curette as recommended by Volkmann is rarely necessary. Sequestra must be removed as soon as they become loose; they should be seized with a pair of stout forceps and gently manipulated or pulled away. Sometimes it is necessary to divide a large sequestrum before it can be removed. When there is bare, fixed bone on the floor of the nose and an exceedingly foetid discharge, the bone may be cautiously scraped with a sharp spoon under a general anaesthetic. It has been recommended that the surface should be dried, and hydrochloric or nitric acid applied to dissolve the necrosed bone; the action of the acid can be arrested by applying a solution of bicarbonate of soda. I have no personal experience of this plan. Large granulomata or polypoid tumours may require removal with a snare. When extensive destruction of the interior of the nose has occurred I prefer to leave these tumours *in situ*: their removal only leaves a larger cavity in which dried crusty secretion may collect, and causes the patient to suffer from all the horrors of ozaena. Instances of this are recorded by Guye. In a patient now under my care the septum and all the turbinate bones have been destroyed. The interior of the nose was at first filled with a large polypus and was clean and free from crusts: the shrinking of the growth led to a condition resembling ozaena. Small adhesions in the nose may be divided by the electric cautery: if there has not been much destruction, and if the adhesions produce obstruction to breathing there is no harm in removing them. Various operations may also be required to remedy the external defects of the nose, or to close perforations in the alae or in the hard palate. These belong to plastic surgery and need not be described here. When extensive external defects have occurred the best device is often a well-made artificial nose. The "saddle-backed" depressions and similar deformities may be remedied by subcutaneous injections of paraffin wax.

HEREDITARY SYPHILIS.

Hereditary syphilis most commonly attacks the nose either within a few weeks after birth or at about the age of puberty. When three or four weeks old the infant may be attacked with what is apparently a severe nasal catarrh. The exact lesion is unknown as it is impossible to examine the interior of the nose. The discharge may be thin at first, but soon becomes purulent, the nasal passages become obstructed, and nasal breathing becomes difficult and noisy, giving rise to the term "snuffles," by which the affection is commonly known. The anterior nares and the upper lip may be excoriated and there are often cracks or fissures at the margin of the nose or at the corners of the mouth. The nasal obstruction gives rise to great difficulty in sucking and in breathing during sleep.



FIG. 95.—SADDLE-BACK NOSE RESULTING FROM INHERITED SYPHILIS.

For these reasons the child's health is liable to suffer greatly quite apart from the syphilis (see page 67). The disease lasts three to four weeks or more unless carefully treated.

Results. There is usually no definite ulceration of the nose, the external parts at any rate are never affected, and caries or necrosis of the cartilages or bones is unknown. The growth of the parts is however often interfered with, and as the patient grows up the nose assumes the "saddle-backed" form. The nasal mucous membrane is often irretrievably damaged and atrophic rhinitis results. Occasionally sinus thrombosis, meningitis, or general septicaemia may occur.

Diagnosis. It must be borne in mind that many other forms of purulent

rhinitis occur in infants and young children quite apart from syphilis (see page 133). The diagnosis depends upon the associated general symptoms. Although the child is born apparently healthy and vigorous, three or four weeks later it becomes small and feeble, with a wrinkled skin and an aged appearance. There is usually a copper-coloured rash, especially round the anus and mouth. Cracks, fissures or condylomata are also common in these regions.

Treatment. Both local and general treatment are required. The general treatment consists in giving mercury either by inunction or by the internal administration of grey powder. After a month if the affection has not subsided under mercurial treatment a few grains of iodide of potassium daily may be administered in milk or cod liver oil. Local treatment is very important. If carefully carried out it greatly aids in the cure and diminishes the risk of subsequent ill results. The nose should be syringed regularly once or twice a day with a mild antiseptic such as a weak solution of permanganate of potash or of sanitas with the addition of a little common salt; this should be very gently introduced with a glass syringe. The infant may be held face downwards or lying on its side, and great care must be taken that too much force be not used. The feeding is most important, and if the infant cannot suck it must be fed with a teaspoon.

The following articles may be consulted.

PARKER. *Lancet*, 1901, i. p. 237.

KUTTNER. *Archiv für Laryngol.*, 1898, vii. p. 272.

TUBERCULOSIS AND LUPUS.

Christiansen¹ found that in three-fourths of the patients attending the Finsen Light Department in Copenhagen for lupus of the skin the upper air passages were also involved: in nearly all these the nose was affected, for the most part primarily. Gerber gives the frequency of tuberculosis as 2.8 per cent. of all cases of nasal disease. Delavan states that the nose was affected five times in 114 cases of tuberculous disease of the upper air passages. F. J. Steward saw three cases of tuberculous disease of the nose in 2777 patients attending his throat clinic; and some statistics of post-mortem examinations which he collected showed only three cases of tubercular disease in the nose in 672 autopsies on patients who died of tuberculous disease. In 100 cases of tuberculous disease of the nose which he collected from medical literature he considered that the disease was primary in the nose in 58. All the last statistics exclude lupus which is much more common: my own clinics invariably include several cases. The older authors attempted to differentiate tuberculosis and

¹ *Journ. of Laryngol.*, 1903, xviii. p. 50.

lupus of the nose, but since Koch demonstrated that the tubercle bacillus was the cause of both affections there is no sufficient reason to perpetuate this distinction. Although there are great clinical differences between the two extremes, rapid tuberculosis and chronic lupus, yet intermediate forms of disease exist, and it is frequently impossible to say in which category a particular case should be classed. When the cause and the treatment are the same there is no advantage in drawing artificial distinctions which depend upon variable clinical differences.

Etiology. The essential cause is the tubercle bacillus. Lupus generally commences on the anterior part of the septum and may be due to direct inoculation by picking the nose with an infected finger. In this same region also the inspiratory column of air, laden with dust and bacilli, first impinges upon the nasal mucous membrane, and it is probable that the infection is often air-borne. One might expect from this that tuberculous disease would be more common, but as already shown the nose is well-protected against bacterial invasion. The presence of the nasal mucus and the constant action of the cilia probably prevent organisms obtaining a foothold unless a small lesion such as an abrasion of the mucous membrane is present. This is opposed to the opinion of Knowles Renshaw, who claims to have proved experimentally that no abrasion is necessary. Tuberculosis, as distinct from lupus, is usually secondary to phthisis and results from infection with the tuberculous sputum. I have seen three or four instances in association with phthisis with or without laryngeal tuberculosis. In a case, under the care of a colleague,¹ the anterior ends of the inferior turbinates were removed in a man with unsuspected pulmonary tuberculosis: the operation wounds became typical tubercular ulcers and subsequently the pharynx, larynx, and skin became affected. Lupus is most common in young adults, and is said to be more frequent in women and in country people: the latter statements appear doubtful. It is usually associated with lupus of other regions: in more than half the cases the skin is affected, at any rate when the patient comes under observation, although the disease may have commenced in the nose and for a time have remained unnoticed. Lupus in the pharynx or larynx, or scarring, the result of previous disease, is also frequently present.

Pathology. Several forms of the affection have been described, but they cannot be sharply differentiated from one another. The most common is the **hypertrophic form**, which exhibits a mass of pale exuberant granulations, covered with dry purulent secretion. The granulations may be large enough to cause considerable obstruction or completely to occlude the nostril. If the disease be active and accompanied by ulceration the nasal discharge will be profuse, purulent and sanious: usually little ulceration can be seen. The affection is most common on the anterior part of the septum, whence it may spread on to the floor of the nose and to the inferior turbinate. Steward in 100 cases found the septum

¹Parker, *Journ. of Laryngol.*, 1902, xvii. p. 200.

affected alone in 70, and together with other regions, in 19. Bronner¹ reports a case in which the middle turbinate was affected. This is very rare: Steward found only 3 instances of tubercular disease of the ethmoid in the 100 cases collected by him. Perforation of the cartilaginous septum is common, but the bony septum is rarely affected. The alae and the vestibule may be attacked and the affection spread thence to the skin. The tip of the nose becomes red, swollen and hard: soon the typical "apple-jelly" nodules appear. The whole upper lip is commonly thickened. The disease may spread up the lachrymal duct and produce a lachrymal



FIG. 96.—PERFORATION OF ALA NASI RESULTING FROM LUPUS.

abscess or lupus of the conjunctiva. Kinsberg² reports 9 instances of nasal tuberculosis, in 5 of which the conjunctiva and lachrymal duct were secondarily involved. As already said the disease frequently spreads to the pharynx, palate, tongue and larynx. Lupus runs an essentially chronic course, it may progress for many years, but unless arrested it usually leads to great destruction and deformity. As healing takes place the anterior nares may be greatly narrowed or almost obliterated, the nasal passages may be stenosed, or obliterated by adhesions, or the interior of the nose converted into a large dry crusty cavity.

An **ulcerative form** of lupus has also been described. The earliest stage is a superficial infiltration or diffuse swelling on the anterior part

¹ *Proc. Laryngol. Soc. of London*, 1901-2, ix. p. 83.

² *Journ. of Laryngol.*, 1902, xvii. p. 218.

of the septum or the anterior end of the inferior turbinate. The swelling is at first firm, pale-pink in colour, with a slightly irregular granulating surface; slowly progressive ulceration follows and may lead to perforation of the septum, of the alae nasi, and to the extensive destruction above described.

The above described forms of tubercle, which are usually very chronic and associated with a similar affection of the skin, were formerly differentiated as lupus.

A rarer form of the affection is the **tuberculoma** or tubercular tumour, which most commonly occurs in patients suffering from phthisis. It forms a single growth varying in size from a pea to a walnut and is generally situated on the anterior part of the septum. It is pale or dark-red in colour with an irregular granulating or smooth surface. It is generally soft, bleeds readily on probing, and is covered with mucous or muco-purulent crusty secretion. It is usually sessile, but large tumours may be pedunculated. The surrounding mucous membrane is usually normal. Steward describes these tumours as occurring in 73 out of 100 cases of nasal tuberculosis.

A **single superficial tubercular ulcer** has also been described. This usually occurs on the posterior part of the septum, more rarely on the inferior turbinate. The ulcer is round, oval or irregular in shape; the surrounding mucous membrane is inflamed, swollen and contains miliary tubercles. These break down, coalesce, and thus the ulceration slowly extends. The base of the ulcer may be almost level with the surrounding mucous membrane, it is greyish or pale in colour and covered with caseous pus which when wiped away reveals scattered reddish projecting granulations. This is a very typical appearance.

The two last described forms of the disease are comparatively rare, are most often met with in patients suffering from phthisis and are the affections which were formerly described as tuberculosis as distinct from lupus.

Tubercle in the nose rarely attacks the bones, but may do so—in fact the disease may commence as a subperiosteal abscess. I have at present under treatment a boy with typical extensive lupus of both nostrils in which the disease has spread to the nasal bones and formed abscesses on the outer side of the nose beneath the periosteum. These abscesses were opened by cutting away the underlying diseased bones from inside the nose.

Histology. Microscopical examination of the bases of the ulcers and of the granulations shows the presence of typical tubercles. The large tuberculous tumours consist mainly of newly-formed fibrous tissue with few tubercles, and unless carefully examined may be mistaken for syphilitic granulomata. The tubercle bacilli may be demonstrated in the tuberculous tissues, but usually are very scanty and difficult to find. The secretion covering the base of a tubercular ulcer may contain numerous bacilli.

Symptoms. In early cases the symptoms of tuberculosis of the nose are variable, usually slight, and in no way characteristic. There is nasal obstruction, especially when a tuberculous tumour or exuberant granulations are present. There may be muco-purulent or purulent discharge, often scanty, with a tendency to form crusts. Epistaxis is uncommon and never profuse: pain is rare. The disease may exist for years even in intelligent patients without attracting attention until it spreads to the throat, eye, or skin and produces external deformity. The rhinoscopical appearances, the affection of the external skin, the destruction of the alae, of the septum, or even of the whole tip of the nose, have already been sufficiently described.

Diagnosis. The disease which most often resembles lupus is tertiary syphilis. The latter is a more rapid process, leads to deeper destruction, and—a point of great importance—frequently attacks the bones: whereas lupus may destroy the cartilages but very rarely extends to the bones. Syphilitic tumours are never so large as the tubercular tumours may become. The differentiation from hereditary syphilis presents the greatest difficulty unless other distinct signs of syphilis are present, such as scarring at the corners of the mouth, Hutchinson's teeth, "saddle-backed" nose, perforation of the palate, interstitial keratitis, etc., or on the other hand there is typical lupus of the skin, pharynx, or larynx. Otherwise the diagnosis must rest upon the result of treatment or upon microscopical examination of a piece of growth. In doubtful cases iodide of potassium should always be administered. The tuberculous tumours may closely resemble a malignant growth, from which indeed it may be impossible to distinguish them except by microscopical examination.

Prognosis. When phthisis is present the prognosis is bad: the presence of disease in the nose and lungs indicates feeble resistance of the patient's tissues, and life probably cannot be prolonged for many months. When there is no disease in the lungs, even if the skin and throat are also affected, the prognosis is good as regards life, although at any time phthisis, meningitis, or other grave form of tubercle may supervene. Most patients with disease of 10, 20 or even more years' duration remain otherwise in excellent health. Renshaw states that the disease runs a slower course when it is situated in the anterior, and a more rapid course when it is situated in the posterior part of the nose. Treatment may result in apparently complete removal of the local affection, but recurrences are always liable to occur.

Treatment. The treatment must be local and constitutional. The **general treatment** consists in placing the patient in the most favourable hygienic surroundings: fresh air, and a plentiful, light, nourishing diet are essential. As is well known, arsenic administered in gradually increasing doses acts almost like a specific in lupus of the throat and may by itself effect a cure. Although its action is much less obvious in lupus of the nose still I believe that it is of considerable benefit. The drug may be

prescribed in the form of liquor arsenicalis and commenced in small doses, which are gradually increased until an adult patient may be taking 10, 15 minims or more three times daily. Of course the usual precautions must be adopted with regard to gastric disturbances, and other signs of arsenical poisoning.

The **local treatment** is a necessary adjunct, and consists in removing as much of the disease as possible. A small ulcer or tubercular deposit may be scraped under local anaesthesia, but if the affection be extensive it is better to give a general anaesthetic. The various forms of sharp spoons, or, better still, a ring knife may be used. After removing all the apparent disease the nose should be lightly packed with strips of gauze soaked in iodoform and glycerine emulsion. After a few days the nose should be thoroughly examined and the galvano-cautery, or a powerful caustic such as chromic acid or nitrate of silver applied to any doubtful spots. The more commonly recommended lactic acid is much less efficient. The packing should be changed daily or on alternate days, and the nose should be cleansed by syringing with a solution of boracic acid or other mild antiseptic. It is a great advantage to exclude the air from the nose so as to prevent the drying of secretion upon the ulcerated surface; for this reason I usually pack the nose or at any rate occlude the nostrils for two to three weeks. If the disease be extensive it will generally be found that a few spots require subsequent operation. The patient should be kept under observation until all the disease is eradicated and subsequently should be seen from time to time so that any fresh outbreak may be treated immediately it occurs. If the disease has been very extensive, when healing has taken place the interior of the nose may be converted into a large, smooth, dry cavity resembling atrophic rhinitis, the symptoms of which may be present. In this case the patient should be instructed to use a nasal lotion constantly. If frequent crusting or excoriation of the mucous membrane occurs he will find much benefit from the use of oils, such as the Pigment. Hydrarg. Nit., applied with a brush or with an atomizer.

Christiansen¹ condemns scraping altogether, fearing it may produce general infection. He recommends repeated applications of the galvano-cautery under cocaine anaesthesia. This is a very tedious procedure when the disease is at all extensive.

When extensive tuberculosis of the nose is associated with tuberculous disease in the lungs or elsewhere, it is often a question as to the advisability of any form of local treatment. If the patient's health is seriously affected it is probably wiser to leave the nose alone, but if the general condition is good, an attempt may be made to remove the local affection.

A **tubercular tumour** may be removed with a snare, and subsequently the base should be thoroughly cauterized. Single tubercular ulcers should

¹ See footnote, page 208.

be cauterized, if necessary, after a preliminary scraping. After such operations it is advisable to pack the nose lightly with strips of gauze.

There are two other methods of treatment of which little is definitely known at present. Treatment by the Finsen Light or by the X-rays is impracticable, but in a few cases my colleague Dr. Sequeira has tried the application of radium to the interior of the nose. The results have apparently been favourable, but the remedy is difficult to control, and we are not yet in a position to speak positively about it. In other cases the opsonic index of the patient's serum to the tubercle bacillus has been tested and when it was found decidedly low, the patient has been treated by tuberculin injections. This method will probably prove valuable, but sufficient time has not yet elapsed to speak definitely of it.

The following articles may be consulted :

- GERBER. Heymann's Handbuch der Laryngol. u. Rhinol., Bd. iii., Wien, 1899.
 CHIARI. Archiv für Laryngol., 1894, i. p. 121.
 K. RENSHAW. Journ. of Pathol. and Bacteriol., 1901, vii. p. 142.
 F. J. STEWARD. Guy's Hospital Reports, vol. liv. p. 249.
 PASCH. Archiv für Laryngol., 1905, xvii. p. 454.
 MYGIND. Archiv für Laryngol., 1905, xvii. p. 484.
 STCLAIR THOMSON. Brit. Med. Journ., 1897.

LEPROSY.

Leprosy is a very rare affection in this country; only one case with disease in the nose has come under my own notice. For the following account I have relied mainly upon the writings of Bergengrün of Riga.

The nose is always affected in *Lepra diffusa* and frequently in the anaesthetic form. In the earlier stages the skin of the nose, eyebrows and surrounding parts become puckered and covered irregularly with scattered nodules. Later the entire nose becomes thickened and misshapen; the anterior nares may be almost obliterated. In the beginning the skin is red, later it becomes brownish and anaesthetic, and finally grey or dark and loses its lustre. Superficial ulcers covered with blood crusts appear and may be followed by gradual destruction of the nose.

The affection often commences in the anterior part of the nasal fossae. It is evidenced by nasal obstruction and its consequences, pain across the root of the nose, giddiness, and epistaxis. The discharge, at first mucopurulent and often foetid, later becomes scanty and crusty. These symptoms may be accompanied by rigors, fever, and general constitutional disturbance. Nodules form in the nose and are often irregular so that the nostrils appear unequal in size and the septum is pushed to one side. The mucous membrane, at first red and velvety, soon becomes pale and yellowish or greyish-white. The nodules increase until the nose seems filled with whitish, flat, compressed tumours, which cause complete obstruction. As their

vessels become obliterated fatty degeneration occurs in the centre of the nodules; rapid ulceration and destruction take place. This is almost invariably painless. There is now profuse discharge in the form of large hard crusts, foetid and blood-stained. The septum and bony framework of the nose are rapidly destroyed, and the nose falls in. Extensive scarring and contraction follow.

The diagnosis must be made from tertiary syphilis, lupus and rhinoscleroma. In the earlier stages when the affection is limited to the interior of the nose it may be easily overlooked; when the skin is affected there is no difficulty.

The treatment consists in palliative measures such as cleansing the nose, removing crusts, etc. Attempts may also be made to prevent the contraction that follows the healing of the ulcers by the daily passage of bougies. If adhesions form they may be divided by the cautery. Little else can be done.

References:

- BERGENGRÜN. Heymann's Handbuch der Laryngol. u. Rhinol., Band iii., Wien, 1899.
KANTHACK. Proc. Laryngol. Soc. of London, 1898, vi. p. 54.

RHINOSCLEROMA.

Rhinoscleroma was first described in 1870 by Hebra¹ who applied the term to a slowly spreading induration of the alae nasi, septum, and upper lip. Mikulicz² showed that the affection commenced inside the nose, and accurately described its histology. Frisch³ in 1882 demonstrated the presence of bacilli in the form of short rods scattered throughout the tissues, and especially numerous in certain large cells described by Mikulicz. Cornil and Alvarez showed that the bacilli were encapsuled. They occur in pairs or groups, rarely in chains: are stained with all the ordinary nuclear dyes, and are not decolorised by Gram's method. The organisms are found in the nasal discharge of affected people, often in large numbers, but direct spread of infection is hitherto unknown, and inoculation experiments in animals have been unsuccessful. The disease is extremely rare in this country, two cases only have been reported, and one of these was a native of Austria.⁴ It is fairly common in Galicia, Russian Poland, Hungary, Bohemia, and occurs in Austria, but the majority of cases seen in the Vienna clinics come from the first mentioned regions. It is said that the disease is found in South Italy, in Central America, and occasionally occurs in almost all races and in all parts of the globe.

¹ *Wien. med. Wochenschr.*, 1870, No. 1.

² *Archiv für klin. Chirurg.*, 1876, xx. No. 2.

³ *Wien. med. Wochenschr.*, 1882, No. 32.

⁴ Dundas Grant, *Journ. of Laryngol.*, 1900, xv. p. 363.

The affection attacks adults of both sexes, is found almost exclusively amongst the very poor, and has been directly attributed to bad nourishment and insanitary surroundings.

Pathology. The disease consists of a dense infiltration involving all the tissues from the epithelium to the cartilage. At first round-celled and vascular, the infiltration soon becomes fibrous, and contraction takes place, leading to great distortion of the parts. The skin becomes hard and cuts easily. The overlying epithelium may be infiltrated with round cells, the hair follicles and sebaceous glands atrophy, and the hair falls out. Occasionally small ulcers appear, but they never become extensive and often heal.

Symptoms.—The disease is extremely chronic, and for intervals of months or years may remain stationary. It begins like a chronic catarrh, and it may be many years before definite signs of induration appear. The discharge, at first muco-purulent, gradually becomes more purulent, crusty and foetid. The induration commences in the post-nasal space around the Eustachian tubes or posterior choanae, and thence spreads downwards into the pharynx and larynx, and forwards through the nose on to the skin. Examination in the earlier stages shows dry crusty discharge covering a pale shrunken mucous membrane. Later, nodules may appear, red and soft, or hard and white, or diffuse infiltration with an irregular surface may be seen. When the inferior turbinate is affected the swelling may obliterate the outline of the structure and reduce the airway to a small passage through the middle meatus. When the vestibule is attacked the alae nasi, the floor of the nose and the septum become swollen: the affection is usually bilateral. The skin of the upper lip and the gums may also be affected. The whole external nose may become swollen: the anterior nares may be reduced to mere slits, or almost obliterated by swellings of cartilaginous consistence. Even the mouth may be contracted until the orifice will not admit a finger.

Diagnosis. The diagnosis depends upon the localisation of the disease, its slow spread, the cartilaginous hardness of the infiltration, and the contraction of the affected parts. From syphilis it is distinguished by the absence of inflammation and deep ulceration and by its slower progress: from tumours by its being bilateral and more diffuse. In doubtful cases a positive diagnosis may be made by microscopical examination of a piece of tissue or bacteriological examination of the nasal discharge.

Prognosis. The affection is chronic and incurable, but the prognosis as regards life is not bad unless the larynx is attacked. Some cases progress slowly, others comparatively quickly, and long periods of apparent arrest may occur.

Treatment. No drugs have any effect, and operations afford only temporary relief. Healing readily takes place even after partial removal, but the most extensive operations will not prevent recurrence. An attempt should be made to keep the nasal passages clear by removing pieces of

the growth with a snare, sharp spoon, cutting forceps or the galvano-cautery, and to prevent subsequent contraction of the parts by inserting metal tubes, or by the frequent passage of bougies. Navratil, in opposition to most authors, advises complete excision of all the affected tissues together with any enlarged glands. He states that excellent results follow this radical procedure. A plastic operation may be subsequently required.

The following articles may be consulted:

NAV RATIL. *Journ. of Laryngol.*, 1900, xv. p. 599.

PIENIAZEK. Heymann's *Handbuch der Laryngol. u. Rhinol.*, Band iii., Wien, 1899.

GLANDERS.

Glanders is a very rare affection in man. It is met with mostly in those whose occupation brings them into contact with horses, in which animal it is common. The disease is caused by the well-known bacillus mallei: infection takes place through abrasions of the skin or from inhalation of the contagion. The incubation period is from three to five days, at the end of which time local inflammation appears, soon to be followed by general symptoms, headache, fever, malaise, pains in the joints and muscles, etc. According to Landgraf the nose is affected in about three-fourths of the cases. There is a profuse, yellowish-brown or blood-stained discharge, with swelling, redness, and tenderness of the nose and the surrounding parts. In acute cases nodules or small tumours appear in the nose, with an erysipelas-like swelling of the face. This is followed by ulceration and destruction of the nose, of the adjoining parts of the face, and even of the upper jaw, with suppuration in the cervical glands. Death usually takes place in about three weeks, but the affection may run a much more chronic course. Ulcers may also occur on other parts of the skin, in the mouth, in the alimentary tract, etc. When the lungs are affected the symptoms resemble those of acute bronchitis. Under the microscope the nodules rather resemble tubercles, but are more vascular, contain no giant cells, and the characteristic bacillus is present.

Diagnosis. From tuberculosis and syphilis the disease may be distinguished by careful attention to the symptoms as above described, and by the more severe constitutional disturbance. The history and the occupation of the patient will often furnish a valuable clue, and inoculation of the discharge from an ulcer into a guinea-pig will quickly clear up any doubt. The general symptoms may resemble those of acute rheumatism, typhoid fever or pyaemia.

Prognosis. The more chronic the affection the better the chance of recovery. Acute cases all die, and the apparently chronic sometimes end acutely. Of 33 cases collected by Landgraf only four recovered.

Treatment. The preventive treatment is the most important: all those

coming in contact with horses should be warned of the danger of contracting the affection. The symptoms in horses are well known, and the nasal discharge is extremely infectious. No one with a small cut or abrasion of the skin should touch an infected horse, and nasal mucus coming in contact with the clothes should not be wiped away with the handkerchief. If infection takes place active local measures should be carried out: the surface of the ulcer should be freely cauterized or cut away. For the rest, all that can be done is to support the patient's health by giving plenty of nourishment.

CHAPTER XIII.

TUMOURS OF THE NOSE AND ACCESSORY SINUSES.

BENIGN GROWTHS.

WITH the exception of polypus, which has already been described, all tumours of the nose are rare. They may be either simple or malignant. The simple tumours include papilloma, fibroma, angioma—the so-called “bleeding polypus” of the septum—enchondroma, and osteoma. Of malignant growths the various forms of sarcoma and glandular carcinoma are the most common. Hasslauer analysed 281 cases reported as tumours of the septum. Of these only 115 were true tumours: they comprised “bleeding polypus” 57, papilloma 35, fibroma 9, myxoma 6, enchondroma and adenoma, of each 4.

PAPILLOMA.

There has been some dispute as to the frequency with which papillomata occur in the nose. Sections through a hypertrophied inferior turbinate show extensive corrugations of the surface and increase of the superficial epithelium, which give them an appearance greatly resembling papilloma. There seems little doubt that some observers, for instance Hopman, have regarded these hypertrophic growths as papillomata. A similar growth may be met with on the middle turbinate, and has already been described as papillary polypus (see page 175). Small excrescences of heaped up epithelium may also occur on any part of a nasal polypus which is exposed to irritation.

Excluding all the above, typical papilloma may be met with in the nose, although it is rare. Morell Mackenzie saw only five instances, in all of which the tumour was attached to the lower and anterior part of the septum. The few cases shown at the Laryngological Society of London have been similar. The growths are usually small, but Logan Turner has described a huge papilloma measuring $6\frac{1}{2}$ inches in circumference. It grew from the septum, obstructed both nostrils, and required an extensive external incision for its removal. Dickerman¹ has recorded a very similar case.

¹ *Journ. of Laryngol.*, 1897, xii. p. 145.

Papillomata more rarely occur on the outer wall of the nose, especially about the junction of the mucous membrane and the skin. Hunter Mackenzie records a case of diffuse papillomatous degeneration of the whole nasal mucous membrane; the diagnosis was confirmed by microscopical examination. Bronner has seen a large papilloma in the antrum. Ordinary cutaneous warts are commonly seen in the vestibule, in which situation they are apt to become inflamed from picking the nose, and then may give rise to a suspicion of epithelioma.

The pathology of these growths need not be described: they present macro- and microscopically the typical appearance of an ordinary cutaneous papilloma. They give rise to few symptoms unless allowed to attain an enormous size: usually they first attract the patient's attention by appearing at the anterior nares. The diagnosis is readily made by inspection aided by the probe, and confirmed when necessary by the microscope.

Treatment. A small pedunculated papilloma can quite easily be removed with a snare under cocaine anaesthesia. The base should be touched with the galvano-cautery or with caustic to ensure complete removal and freedom from recurrence. When a wart is much inflamed it may be advisable to excise it freely, removing a small area of the surrounding mucous membrane or skin. These growths sometimes occur in the small recess in the most anterior and upper part of the nasal vestibule at the junction of the alae with the septum, when it may be necessary slightly to notch the nostril to enable the base of the growth to be reached. This need not produce any subsequent deformity.

The large growths described by Turner and others may require removal through an external incision. Probably Rouge's operation would usually suffice.

FIBROMA.

Fibroma is extremely rare. No example has hitherto occurred in my own practice, and I have seen but one instance. The growths may spring from the outer wall or roof of the nose, but are most common on the septum. Stewart¹ has recorded an enormous growth measuring 4 inches by $2\frac{1}{8}$ by $1\frac{5}{8}$. It was attached to the septum and there was a history of 25 years of nasal obstruction. The upper jaw had to be displaced to obtain access to it.

A similar case is recorded by Lefferts. Knight² has described a fibroma attached to the middle turbinate: Kelson³ enucleated a fibroma the size of an egg from the vestibule: and Powell⁴ has recorded a case involving the antrum. Fibromata have deep attachments usually to the

¹ *Journ. of Laryngol.*, 1896, x. p. 56.

² *Journ. of Laryngol.*, 1896, x. p. 156.

³ *Journ. of Laryngol.*, 1902, xvii. p. 28.

⁴ *Journ. of Laryngol.*, 1902, xvii. p. 367.

periosteum; they consist of firm fibrous tissue arranged in concentric bundles, but occasionally partial myxomatous degeneration is met with.

Symptoms. The growths are usually lobulated or irregular in outline, firm, opaque, and of a pink or dark-red colour. They have a broad attachment and are immobile to the probe. In the earlier stages the patient complains of gradually increasing nasal obstruction with all its attendant symptoms. There is more or less muco-purulent discharge from the nose, which later may become purulent and foetid. There is great liability to epistaxis. As the growth increases in size it distends the nasal fossa, the septum is pushed over to the opposite side and the surrounding cavities are encroached upon. There is bulging or separation of the nasal bones with widening of the bridge of the nose; the eyes are displaced outwards and forwards causing diplopia; the hard palate becomes depressed, there is deafness from Eustachian obstruction, and epiphora from pressure on the nasal duct. This facial deformity is known as "frog face." The progress of the disease is accompanied by severe headache and neuralgia. The growth may extend into the pharynx and produce dysphagia and dyspnoea. It destroys life by exhaustion, by repeated epistaxis, or by pressure upon the brain, causing convulsions and coma.

Treatment. The earlier these tumours are removed the better. It is not difficult to make a diagnosis, and as soon as this can be done a thorough operation should be undertaken. If the growth be small it may be possible to remove it with a thick wire snare. The tumour is cut through as near its base as possible and subsequently the stump should be cauterized. It must be borne in mind that these growths are extremely tough and therefore a thick wire and a strong snare must be employed. If preferred a hot wire snare may be used. If the growth has attained to large dimensions an extensive surgical operation may be required for its removal. It is unnecessary to consider these in detail here, as they will be described in connection with malignant disease of the nose. The nasal fossae must be laid open as thoroughly as possible so as to obtain a good view of the growth, which should be removed together with the periosteum, and if necessary with the bone from which it is growing. If a thorough operation of this kind be carried out the prognosis is good.

CHONDROMA OR ENCHONDROMA.

Enchondroma is extremely rare in the nose. Morell Mackenzie met with one: no case has hitherto occurred in my practice, nor has one been exhibited in the last ten years at the Laryngological Society of London. Reports of 29 cases have been collected by Suard.¹ A perusal of the literature shows that the majority of patients have been under the age of 18. The tumour grows either from the cartilage of the septum or from

¹Thèse de Paris, 1897. Ref. *Journ. of Laryngol.*, 1897, xii. p. 700.

the roof or outer wall of the nose. The symptoms are almost identical with those produced by fibroma (see above), from which it may be difficult to make a diagnosis. Like fibromata they are slowly growing tumours, which gradually expand the nose and distort the face, invade the neighbouring cavities and usually prove fatal from pressure on the brain. The diagnosis from fibroma is not of much importance, in that the treatment is exactly the same. Of course the term enchondroma does not include the spurs, crests or thickenings of the cartilaginous septum which are so frequently met with, and which have already been described in the chapter on deformities of the septum.

OSTEOMA.

True osteoma of the nose is not quite so rare. The ridges, spurs or crests of the septum sometimes called exostoses must of course be excluded from this category. An osteoma may grow from any part of the nose, but



FIG. 97.—EXOSTOSIS OF ETHMOID, PROJECTING INTO THE ORBIT AND CAUSING PROPTOSIS AND OUTWARD DISPLACEMENT OF THE EYEBALL.

most commonly springs from the ethmoid bone or it may commence in one of the accessory cavities and thence invade the nose. In the majority of recorded cases the growth has commenced under 20 years of age. The tumour is usually pedunculated and may be hard and of ivory consistence or soft and cancellous in structure. It gives rise to gradually progressive nasal obstruction and its associated symptoms.

Headache and severe neuralgia are common, but may be absent. The growth is pinkish or red in colour and may be concealed from view by nasal polypi or oedematous mucous membrane. Epistaxis may occur, but is not frequent. A muco-purulent discharge is commonly met with, especially when the growth becomes large. As the tumour increases in size it produces displacement of the neighbouring parts usually in a somewhat irregular manner. Thus the growth may protrude into the orbit, causing a swelling on its inner wall and displacement outwards of the eyeball; it may obstruct the lachrymal duct and cause overflow of the tears. It may extend up through the cribriform plate producing intense headache and other symptoms of intracranial pressure. The growth



FIG. 98.—IVORY EXOSTOSIS OF ETHMOID. The upper part of the tumour, above the constriction, projected into the orbit: the lower part presented in the middle meatus. It was concealed from view on rhinoscopy by the polypi attached to its lower margin.

may occlude the ostium of one of the accessory sinuses such as the frontal sinus or antrum and give rise to a mucocele. This is usually accompanied by severe neuralgic pain (see Chap. XXIII.). In a case referred to me by Mr. Lang, from Moorfields Ophthalmic Hospital, the growth had attained the size of an inch and a quarter at its longest, and of about half an inch at its shortest diameter. Half of this growth lay in the orbit: the other half projected into the nose, where it was completely concealed from view by nasal polypi (Fig. 98). The association of the polypi with the hard swelling in the orbit led to the diagnosis of a large ethmoidal bony cyst. The operation consisted in making a curved incision around the inner margin of the orbit and in thoroughly exposing the orbital part of the growth. An attempt to chisel away this portion, which was very hard, loosened its attachment to the orbital plate, and the large mass

of growth presenting in the nasal fossae was then recognised. Although the tumour was thus loosened it was necessary to cut away a large part of the orbital plate of the ethmoid and even part of the nasal process of the superior maxilla in order to deliver the growth through the orbit. The patient made an uneventful recovery. Ordinary nasal polypi are seen actually growing from the specimen. Similar cases have been recorded by Helferichs,¹ by Milligan, in whose case the growth projected into the antrum and compressed the lachrymal duct, and by De Santi, in whose case the growth produced a mucocele of the frontal sinus. A more advanced case is recorded by Grossman, who observed the patient for upwards of 20 years, during which time the growth destroyed the sight of one eye. After the eye had sloughed and had been removed, the growth was operated upon with a fairly successful result. A smaller similar growth had been previously removed from the left orbit with an excellent result.

Thelwall Thomas has recorded an exostosis of the frontal sinus projecting into the orbit, and Hamilton has related two similar cases.

Treatment. No definite lines can be laid down for the treatment of every case. The best plan consists in laying open the nasal cavity as freely as necessary so as to bring the attachment of the growth fairly into view. With chisel or cutting pliers it should then be possible to remove the osteoma together with the plate of bone to which it is attached. In this way, providing that the growth has not already extended to the cranium, good results should be obtained. There is probably very little fear of recurrence.

FIBRO-ANGIOMA.

Although these growths are very inadequately described in text-books they are probably the commonest of all simple tumours of the nose. Notes of individual cases, usually under the term of "bleeding polypus" of the septum, are by no means infrequent in recent literature. Cases have been exhibited by Bond,² Thomson, Spicer, Hunter Tod,³ and others in the Laryngological Society of London, and three have occurred in my own practice. Sometimes they have been erroneously regarded as malignant. Thus Baker⁴ has recorded a case under the designation of adeno-sarcoma.

Symptoms. These growths are most frequent in adults. They give rise to gradually increasing nasal obstruction and to frequent attacks of epistaxis, which may lead to profound anaemia. On examining the nose

¹ *Journ. of Laryngol.*, 1895, ix. p. 751.

² *Journ. of Laryngol.*, 1897, xii. p. 47.

³ *Journ. of Laryngol.*, 1903, xviii. pp. 257 and 262.

⁴ *Laryngoscope*, 1899, vii. p. 213.

the cause of the symptoms is at once apparent. A tumour usually about the size of a small cherry, red, vascular and smooth is seen attached by a broad base to the cartilaginous part of the nasal septum. It is usually soft and bleeds readily on touching with the probe.

Pathology. Although these tumours have frequently been regarded as malignant and microscopically have been described as sarcoma and angio-sarcoma, they are in reality benign. They consist for the most part of a fine network of young fibrous tissue with numerous thin-walled vessels, and are covered with a layer of normal epithelium. In places, especially around the vessels, may be seen collections of round cells: in other parts degenerated tissue with haemorrhages may be found. Some growths are much more cellular than others. The general appearance and structure is similar to that of the ordinary angioma of the skin. Bulloch,¹ who reported on one of Tod's cases, described the growth as a perithelioma.

Glas considers the tumours are closely related etiologically to rhinitis sicca anterior and perforating ulcer of the septum. The irritation produced by the crusts leads to ulceration, if organisms gain admission to the tissues, and to tumour growth, if no micro-organisms are present.

Prognosis. Apparently these tumours have considerable tendency to recurrence, many of the recorded cases having recurred two or three times after removal. This is probably the result of imperfect operation: if the growth be eradicated it will not return. In no case has the clinical history pointed to malignancy: there is no record of metastatic deposits, no enlargement of the lymphatic glands, and no destruction of the surrounding tissues.

Treatment. From what has already been said it will be seen that radical surgical treatment is necessary. It probably makes little difference how the growth is removed provided its removal is thorough. Under local anaesthesia the bulk of the mass may be cut off with a snare, and the base thoroughly seared with the galvano-cautery. The cauterization may be repeated in a few days. Another excellent plan is to cut through the mucous membrane all round the attachment of the growth with a red-hot galvano-cautery knife. Having divided the soft parts down to the cartilage, the mucous membrane and perichondrium forming the base of the growth is detached with raspatory or blunt dissector. In this way the whole of the growth with its attachment down to the cartilage is removed. Since the necessity for thorough removal has been recognised less has been heard of recurrence.

Lipoma and Adenoma. Of these extremely rare growths one instance of each has been recorded in recent years. Gomperz² describes a lipoma the size of a cherry growing from the septum. It was successfully

¹ *Journ. of Laryngol.*, 1903, xviii. p. 257.

² *Monatschr. für Ohrenheilk.*, 1894, xxvii. p. 280.

removed with a snare, and the diagnosis was confirmed by microscopical examination. Eichler¹ records an adenoma of the septum.

The following works may be consulted:

MAGNUS. *Archiv für Laryngol.*, 1905, xvii. p. 433.

HASSLAUER. *Archiv für Laryngol.*, 1900, x. p. 60.

Papilloma.

HUNTER MACKENZIE. *Lancet*, 1896, ii. p. 460.

LOGAN TURNER. *Proc. Laryngol. Soc. of London*, 1896-97, iv. p. 21.

HELLMAN. *Archiv für Laryngol.*, 1897, vi. p. 171 (contains full references).

BRONNER. *Journ. of Laryngol.*, 1902, xvii. p. 372; *Proc. Laryngol. Soc. of London*, 1901-2, ix. p. 114.

Exostosis.

ANDREW. *Medical Record*, 1887, p. 261.

GROSSMAN. *Brit. Med. Journ.*, 1902, ii. p. 1425.

THELWALL THOMAS. *Brit. Med. Journ.*, 1896, ii. p. 1132.

MILLIGAN. *Journ. of Laryngol.*, 1897, xii. p. 490.

DE SANTI. *Journ. of Laryngol.*, 1898, xiii. p. 297.

HAMILTON. *Journ. Amer. Med. Assoc.*, 1901, xxxvi. p. 246 (gives statistics of frontal sinus tumours).

Fibro-Angioma of Septum.

HUNTER TOD and others. *Proc. Laryngol. Soc. of London, Journal of Laryngol.*, 1903, xviii. pp. 257 and 262.

GLASGOW. *New York Med. Journ.*, 1898, lxvii. p. 39.

THOMSON and discussion. *Laryngol. Soc. of London, Jan., 1904. Journ. of Laryngol.*, 1904, xix. p. 195.

GLAS. *Archiv für Laryngol.*, 1905, xvii. p. 22.

SENDZIAK. *Journ. of Laryngol.*, 1896, x. p. 103.

ROTH. *Archiv für Laryngol.*, 1904, xvi. p. 524.

SCHWAGER. *Archiv für Laryngol.*, 1894, i. p. 105.

SCHADEWALT. *Archiv für Laryngol.*, 1894, i. p. 259.

ALEXANDER. *Archiv für Laryngol.*, 1894, i. p. 265.

SCHEIER. *Archiv für Laryngol.*, 1894, i. p. 269.

HEYMANN. *Archiv für Laryngol.*, 1894, i. p. 273.

PEGLER. *Lancet*, 1905, ii. pp. 1455, 1537.

MALIGNANT DISEASE OF THE NOSE.

Both sarcoma and carcinoma may occur in the nose, the former being the more common, even when the fact is allowed for that a large number of growths formerly described as alveolar sarcoma are now considered to be carcinoma. Both forms of malignant disease are rare, and do not amount to more than 5 in 10,000 cases of nose and throat diseases (Moritz Schmidt). These figures closely agree with my own experience.

Herzfeld in 28,000 out-patients saw only one case of malignant disease of the nose, Finder saw 5 cases in 40,000. In 848 cases of sarcoma,

¹ *Archiv für Laryngol.*, 1898, vii. p. 466.

the nose was the site of disease in 15, whilst in 9,554 cases of cancer the nose was affected in 4. Gurlt in 10,000 cases of malignant disease found the nose affected in 18, in four by carcinoma and in fourteen by sarcoma.

SARCOMA.

Of sarcomata the most common variety is the small spindle-celled growth. It forms a soft, rapidly growing tumour with a broad, deep attachment. It most commonly springs from the anterior part of the septum; more rarely from the ethmoidal region. It is often difficult to differentiate this tumour from an inflammatory growth. A sarcoma is usually distinguishable by its deep attachment, its broad base and often by its larger size, by its



FIG. 99.—MICROSCOPICAL SECTION OF A ROUND-CELLED SARCOMA. To the right is seen the edge of the growth; to the left a typical nasal polypus, which, whilst *in situ*, concealed the sarcoma from view.

pressure causing absorption of the surrounding bones and by the penetration of processes extending from the main tumour into the various sinuses. If any doubt remain, a small piece of the growth should be removed and submitted to careful microscopical examination. Sarcoma can be distinguished from fibroma by its comparative softness and its more rapid growth, although it must be admitted that soft fibromata, especially those originating in the post-nasal space may closely resemble sarcoma both in their clinical features and microscopical appearance and it may be impossible to draw a sharp dividing line between them.

The other common form of sarcoma is the small round-celled variety. It may be attached to the septum, especially at its anterior part, or to the outer wall of the nose in the region of the inferior or middle turbinate. The tumour grows rapidly, soon ulcerates and breaks down. It usually presents the appearance of a sloughy mass accompanied by profuse, purulent, sanious, foetid discharge; the whole nose may appear filled with soft necrosing masses. Lympho-sarcoma, five cases of which have been recorded by Moritz Schmidt, is closely allied to, if not identical with, this form.

Myxo-sarcoma and adeno-sarcoma have also been described, growing generally from the anterior part of the nasal septum. It is doubtful if some of the tumours to which these terms have been applied would not have been more correctly described as fibro-angioma (see page 224).

A few instances of melanotic sarcoma are on record; in one or two the diagnosis seems to have been established beyond doubt, but in others the pigment was probably the result of old haemorrhages. Cozzolino¹ gives a full description with microscopical examination of such a tumour removed from the nasal vestibule. Probably the growth may sometimes originate in the organ of Jacobson.

Lastly, myeloid or giant-celled sarcoma has occasionally been met with, generally growing from the bony septum, or from the upper jaw and spreading thence into the nose; in a case reported by Waggett the tumour grew from the middle turbinate.² They are the least malignant variety of sarcoma. Waggett describes the tumour as consisting of a branch work of bony trabeculae containing numerous giant cells. I have once met with a growth consisting of an interlacing network of bony trabeculae containing fibrous tissue with a few cells, which was probably a sarcoma. The tumour had the consistency of a hard cheese and grew from the middle turbinal region. Osteo-sarcoma of the antrum has been recorded by Tresilian.³

Alveolar sarcoma has often been described as the most common of all sarcomata in the nose, but the growths to which this term has been applied are in reality columnar-celled carcinomata.

The most common sites of sarcoma are the nasal septum and especially its anterior part, the outer wall of the nose in the immediate neighbourhood of the inferior turbinate, and the ethmoidal region. Finder, however, states that the most common point of origin is the middle turbinate, which accounts for 50 per cent. of cases, and that next in order of frequency come the inferior turbinate (21 per cent.), the septum, roof of nose, base of sphenoid and antrum. These data are based on an analysis of 42 cases.

Symptoms. The early symptoms are not characteristic. They consist of nasal obstruction with its consequences, and epistaxis. The

¹ *Archiv für Laryngol.*, 1903, xv. p. 77.

² Waggett, *Journ. of Laryngol.*, 1902, xvii. p. 206.

³ *Journ. of Laryngol.*, 1901, xvi. p. 157.

obstruction rapidly increases until it becomes complete; the tumour pushes over the nasal septum and thus obstructs both nostrils. Epistaxis may occur in the non-ulcerating growths or before ulceration has commenced: it is an early and important sign. It may be severe and frequently recurring, exhausting the patient's strength and rendering him anaemic. Pain, local, constant, and gradually increasing in severity is another important and grave symptom. Although by no means always present in sarcoma, it is so rare in ordinary nasal polypus that it should always excite attention. These symptoms are associated with muco-purulent or purulent, often foetid and blood-stained discharge, which may cause excoriation of the upper lip. As the growth progresses it distends the nose and invades the neighbouring cavities. The results of pressure depend upon the situation of the tumour. If a sarcoma be situated high up in the nose there is a great tendency for it to perforate the cribriform plate and dura mater, and to invade the frontal lobe of the brain. The invasion of the cerebral cavity is indicated by severe headache, vertigo, cerebral vomiting and the gradual onset of other signs indicative of cerebral pressure. More rarely meningitis or cerebral abscess may occur suddenly without any premonitory symptom, or extensive involvement of the cerebral cavity may be discovered at an operation without being previously suspected. If the growth be situated in the posterior ethmoidal region, extension to the cerebral cavity is indicated in the first instance by involvement of some of the cerebral nerves. Thus blindness may result from interference with the optic tracts, or severe neuralgia followed by anaesthesia of the facial region, from pressure upon the branches of the fifth nerve: various oculomotor disturbances may also occur. A tumour of the anterior ethmoidal region may perforate into the orbit, and push the eyeball outwards producing diplopia; blindness from interference with the optic nerve and, ultimately, total destruction of the eye often follow. It may also extend into the frontal sinus and thence reach the cerebral cavity, or it may perforate the nasal bones and produce great expansion of the bridge of the nose. A tumour growing from the lower part of the outer wall of the nose commonly spreads into the antrum and produces a mucocele or empyema of that cavity. Subsequently, distension of the antrum and great facial deformity may occur: at a late period it may be impossible to say whether the tumour started in the antrum or in the nose. Nearly all these growths are associated with ordinary nasal polypus and they are very liable to be treated as cases of polypus or of sinus suppuration with polypus, the existence of malignant disease being entirely overlooked.

On examining the nose various appearances may be found. If the growth itself can be seen, it may attract attention by its dark-red, fleshy appearance. It may be soft or firm: its surface smooth, ulcerated or necrotic. If nasal polypi are present the tumour itself may not come into view until they have been removed. Usually the appearance of the growth is sufficient to excite suspicion as to its nature, but occasionally it resembles

a pinkish smooth fibrous polypus so closely that suspicion is first aroused on attempting to remove it. It will then be found that the growth is firmly attached by a broad base, and that partial removal is followed by profuse haemorrhage.

Diagnosis. Attention to the foregoing symptoms will usually be sufficient to prevent the error of overlooking the presence of malignant disease. It may be impossible to determine whether a sarcoma or carcinoma is present except by the removal of a piece of the growth for microscopical

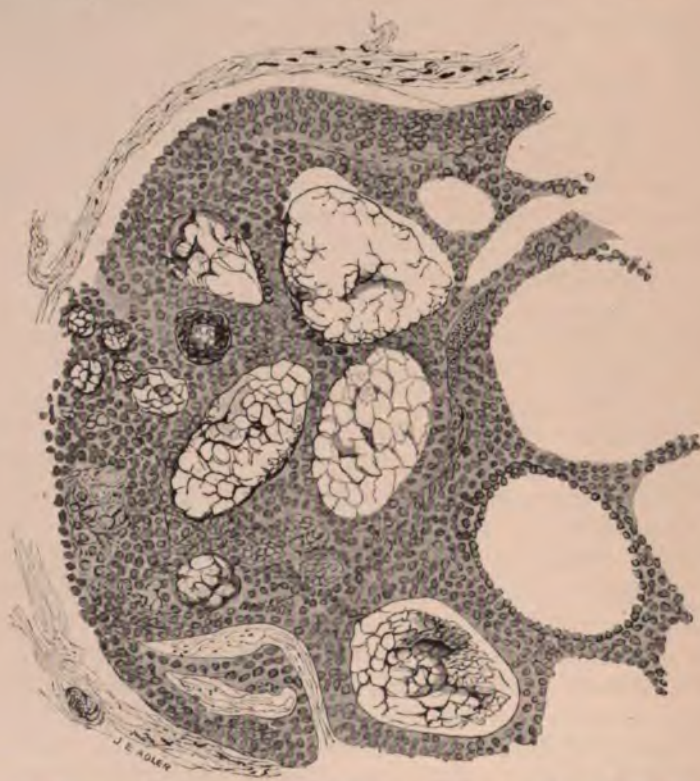


FIG. 100.—MICROSCOPICAL SECTION OF AN ENDOTHELIOMA OF THE ANTRUM. It presents the typical appearance of this kind of growth.

examination, but as the treatment and prognosis of the two diseases is essentially similar this is of little importance. The most difficult cases are those in which a malignant growth is associated with sinus suppuration and with ordinary nasal polypi. The following points deserve attention. In sarcoma of the antrum there will probably be found some bulging in the region of the canine fossa or of the roof of the mouth or of the inner wall of the antrum. Perhaps pale fleshy granulations may be seen in the nose either just above or below the inferior turbinated body. These granulations are apt to be excessive, and their removal fails to

stop progressive increase of the deformity: they bleed freely when touched and recur rapidly. Another important sign is dilatation of the cutaneous capillaries over the cheek. Later the patient exhibits cachexia and general signs of malignant infection. The glands in the neck may or may not be enlarged: secondary deposits in the body are uncommon. In one case under my care, a round-celled sarcoma of the outer wall of the nose, secondary deposits occurred in the liver.

Prognosis. The possibility of extirpating the growth depends in part upon its nature, and in part upon its place of origin; thus the spindle-celled sarcomata are easier to eradicate than the round-celled, and are less liable to be associated with secondary deposits. A growth springing from the anterior part of the septum is comparatively easy to deal with, and the same applies in less degree to tumours springing from the outer wall of the nose immediately above or below the inferior turbinate. A tumour affecting the ethmoidal region is almost certain to recur however free the operation may be. Even in this region, however, a tumour may be removed and the patient's life prolonged. It is probable that almost every case of sarcoma of the nose ultimately ends fatally. The treatment will be discussed later (see page 235).

A few instances of **endothelioma** affecting the nose have recently been recorded. They commenced in the ethmoidal region, were apparently of rapid growth and soon spread to the cranial cavity. Endothelioma is more common in the antrum; one case has occurred in my own practice,¹ and others have been recorded by Kirschner.² It is possible that if all malignant tumours of the nose were carefully examined with the microscope the endotheliomata would figure more frequently. As far as is at present known the clinical signs and prognosis are the same as in sarcoma for which the disease has hitherto been mistaken. The microscopical appearances of endothelioma are very characteristic (see Fig. 100).

CARCINOMA.

Two forms of carcinoma are met with—the alveolar and the squamous. The **alveolar carcinoma** consists of large masses of cubical epithelial cells surrounded by a scanty matrix of fibrous tissue. In places the matrix may be degenerated and fail to take a nuclear stain. The tumour is soft, grows rapidly, and ulcerates early: its surface is often covered with sloughs or necrotic masses. It most commonly affects the ethmoidal region of the nose, arising from the ciliated epithelium in this region. The tumour often appears to be pedunculated and not infrequently is concealed from view by masses of nasal polypi or by oedematous mucous membrane.

¹ *Journ. of Laryngol.*, 1904, xix. p. 212.

² See *Bibliography*.

This form of cancer is sometimes described as adeno-carcinoma¹ and formerly was often confused with sarcoma.

Squamous epithelioma is most often met with as an ulcer with hard raised edges and with its surface covered with large florid granulations. It most commonly springs from the anterior part of the nasal septum, the floor of the nose or the anterior end of the inferior turbinate: but it is often impossible to say, when the patient comes under observation, where the growth originally commenced. This form of cancer grows more slowly and gives rise to less marked symptoms than the alveolar form. It is

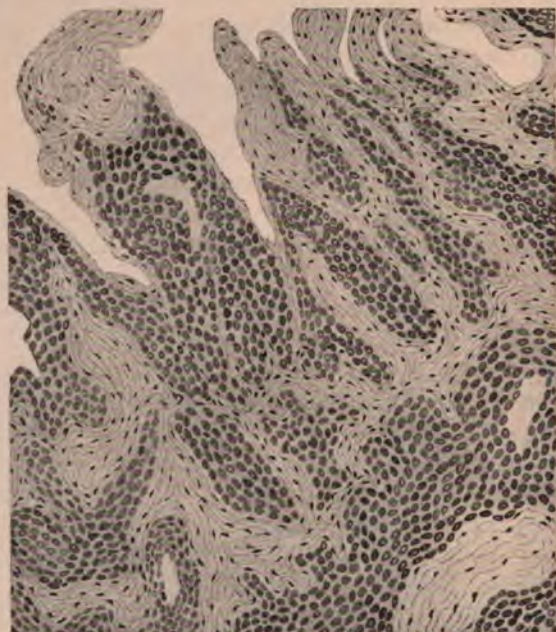


FIG. 101.—ALVEOLAR CARCINOMA OF NOSE.

most often seen in men at or past middle age, but Semon² has recorded a case in a man aged 24. Compared with cancer in other regions carcinoma of the nose grows more slowly, glandular involvement is extremely rare, or occurs very late, and metastases are almost unknown.

Primary carcinoma may also be met with in the accessory sinuses. Wendell Phillips has related a case of epithelioma of the antrum, and collected notes of 15 others from medical literature. His patient remained well 14 months after operation. Onodi and Bartha³ relate a case of primary cancer of the frontal sinus in which operation was soon followed

¹ *Archiv für Laryngol.*, 1898, vii. p. 107.

² *Proc. Laryngol. Soc. of London*, 1904, xi. p. 188.

³ *Archiv für Laryngol.*, 1903, xv. p. 167.

by recurrence. Iwanoff described a similar case and found records of 4 others: every case proved fatal, usually from septic infection of the brain. Citelli records a primary cylindroma of the sphenoidal sinus. The disease spread toward the cerebral cavity and affected the optic nerves causing blindness, first in one eye and then in the other. There was also exophthalmos from pressure on the cavernous sinus, with headache and signs of cerebral pressure. From these scanty records it will be seen that primary malignant disease of the accessory sinuses is extremely rare. The disease leads to distension of the walls of the cavities usually in an irregular manner, and spreads to neighbouring regions. Malignant disease of the antrum may be successfully treated in the early stages by excision of the upper jaw. In disease of other cavities the diagnosis will probably be made too late to enable complete removal to be carried out.

Causation. Cancer in the nose has been ascribed to repeated colds or to irritation from such causes as the frequent passage of the Eustachian catheter. It has also been said that the squamous epithelioma is preceded by a squamous transformation of the epithelial cells. This change is quite possible, as has already been pointed out in the chapter on ozaena. It may result from ulceration or from prolonged and severe inflammation of the nose, but that it invariably precedes epithelioma is yet to be proved. Much has been written to show that the ordinary nasal polypus may, as the result of repeated operations, undergo malignant transformation. This view is open to criticism. Bertemès¹ has carefully reviewed all the known cases and added two of his own, without discovering any proof that a malignant transformation had ever occurred. Malignant disease involves the bone and causes oedema of the surrounding mucous membrane, indistinguishable from nasal polypus. These polypi may repeatedly recur and be removed before their cause is suspected. It is quite common for malignant disease in the nose to be mistaken for simple nasal polypus until some of the growths have been removed. An interesting case in this connection was privately reported to me. An extensive rodent ulcer of the cheek spread deeply towards the antrum and caused destruction of the underlying bone. The mucous membrane on the antral side of the affected bone was covered by ordinary nasal polypi, or oedematous growths indistinguishable from polypi, both macro- and micro-scopically. It will readily be seen, then, that if a malignant growth commences in the antrum it may cause nasal polypus, and the patient may be treated for this for a long time before the primary malignant growth is discovered.

Symptoms. The symptoms of carcinoma are similar to those of sarcoma. There is unilateral, slowly progressive nasal obstruction with its consequences. This is accompanied by a muco-purulent or purulent discharge. Pain is often an early and marked symptom, and may first excite suspicion of the true nature of the disease. Epistaxis is common, although apparently not so frequent as in sarcoma: it may take the form of severe

¹ *Revue Hebdomadaire de Laryngologie*, 1900, xx, p. 318.

haemorrhages or merely discolour the nasal discharge. In alveolar carcinoma the discharge is foetid, sanious, and purulent. When springing from the ethmoidal region this growth commonly assumes the form of a polypoid mass with a broad attachment, ulcerating on the surface, and bleeding readily when touched with the probe. As the growth increases in size considerable deformity may result. The bridge of the nose may become uniformly expanded, but more often the growth eats its way through the bone and causes localised bulging. The bone becomes absorbed; a fluctuating swelling forms under the skin, which ultimately becomes involved, breaks down and ulcerates. A squamous epithelioma more commonly presents the form of an extensive ulcer of the septum or floor of the nose or adjacent parts, covered with firm reddish exuberant granulations. Necrosis of the surrounding bone may occur and the tumour may spread in various directions, and involve any of the adjacent cavities. This form of growth is very liable to lead to suppuration in the antrum, and if polypi are also present the difficulties in diagnosis are obvious.

Diagnosis. The ordinary *nasal polypus* may be associated with a malignant growth and conceal it from view. Attention should be directed to the possibility of malignant disease, if the patient be middle aged or old, if there be much pain, if there be any bulging or deformity of the nose, if the discharge be foetid or sanious, and especially if the bone disease and the deformity of the nose be not arrested by simple removal of the polypi. Localised bulging of the nose with dilatation of the overlying cutaneous veins is very suggestive. Sometimes the diagnosis cannot be determined until attempts have been made to remove the growths. There is then often found to be considerable difficulty in passing the wire loop round the tumour, and its broad attachment becomes apparent. Profuse haemorrhage may follow removal of a piece. Finally the microscopical examination of the growth will clinch the diagnosis.

Tertiary Syphilis may be recognised by the more extensive and rapid destruction it produces, by the signs of syphilis elsewhere and by the effects of specific treatment. Syphilis most often attacks the bony septum, alone or in association with other parts, and rapidly causes necrosis. Microscopically, the most important characteristic of syphilis is the thickening of the inner coats of the small arteries.

Tubercle or Lupus may closely resemble epithelioma. Both affections are most common on the anterior part of the septum, floor or outer wall of the nose, and both give rise to exuberant granulations. Lupus, however, is a slower process, the granulations are paler, the discharge is less and epistaxis is more rare. Of course if the disease commenced whilst the patient was young, if there is also lupus on the skin, in the throat, or if both nostrils are affected the diagnosis is obvious. Difficult cases must be decided by removing a piece of growth for microscopical examination.

Osteoma, enchondroma and fibroma can be detected by their hardness

and slow rate of growth: all are very rare. The *angioma* of the septum is more or less pedunculated. A *foreign body* embedded in granulations may occasionally give rise to difficulty, but examination with the probe or with a blunt hook should prevent mistakes, if the possibility be borne in mind.

Prognosis. In alveolar carcinoma growing from the ethmoidal region the prognosis is bad: the tumour grows rapidly and is extremely difficult to eradicate. Death takes place from exhaustion or from extension to the brain—cerebral pressure, meningitis, or abscess. In my most successful case recurrence took place in a little over two years after operation.

Epithelioma is a slower growth: it often occurs in the anterior part of the nose where it is accessible to surgical treatment the results of which are not unfavourable. Even with imperfect operations the fatal issue may be postponed 4 to 5 years or even longer.

Treatment. In discussing the treatment, all malignant tumours, both sarcoma and carcinoma, may be considered together as they present identical problems. The first point to be considered is the feasibility of operation, for no treatment other than surgical holds out hope of success. From an operative point of view, malignant growths may be classified into four groups, depending upon the region affected.

(1) Tumours of the anterior part of the septum, floor, or outer wall of the nose below the middle turbinate.

(2) Tumours of the ethmoidal region.

(3) Tumours of the base of the sphenoid or posterior part of the nose.

(4) Tumours involving the accessory sinuses.

1. **Growths in the anterior part of the nose** are the most accessible to surgical treatment. As already said, an epithelioma in this region, shut in by bony walls, tends for a long time to be strictly localised: involvement of the glands and secondary deposits are rare and always late in the course of the disease. The following methods may be considered.

Curettement. This method has been especially advocated by Dr. J. W. Bond.¹ Under a general anaesthetic he scrapes away as much of the growth as possible, removing everything down to the bone. Subsequently the galvano-cautery or a chemical caustic is freely applied. If when healing is taking place any suspicious granulations or nodules appear, further scraping followed by cauterization is carried out. Dr. Bond, at the Laryngological Society of London in December, 1898,² exhibited an old man in good health and free from growth, who had been operated on three times by this method—the first time no less than six years previously. Black³ reports a case remaining well two

¹ *Journ. of Laryngol.*, 1896, xi. p. 86, and 1897, xii. p. 47.

² *Journ. of Laryngol.*, 1899, xiv. p. 80.

³ *New York Med. Journ.*, 1896, lxiv. p. 222.

years after scraping, and Price Brown¹ reports good results in three cases from similar operations. The method therefore appears to deserve a trial in certain cases, and cannot be lightly discarded.

Rouge's Operation. Personally, however, I prefer to bring the affected parts into full view by performing a preliminary Rouge's operation. This gives direct access to, and a perfect view of, the anterior parts of the nose without any subsequent scarring or deformity. The growth with a surrounding piece of healthy mucous membrane and as much of the underlying bone as desired can be cut away cleanly and thoroughly. The following points in the operation may be noted. If the growth be extensive and there is likely to be much bleeding, it is convenient to perform a preliminary laryngotomy, a proceeding which adds nothing to the danger of the operation, and avoids all trouble with blood entering the air passages and interfering with the anaesthetic. The short time occupied in the operation is more than compensated for by the time saved in sponging away blood. The back of the pharynx is then packed with one or more large sponges. The incision is made in the gingivolabial margin from the level of the first molar tooth on one side to the corresponding point on the other. The tissues are divided close to the bone, the upper lip and nose detached from the jaw, and pulled well up over the face. The cartilage of the septum is cut through well in front of the growth. If the tumour spring from the outer wall of the nose, an opening should be made through the canine fossa into the antrum near its anterior margin, and the whole of the wall separating this cavity from the nose can be cut away. The floor of the nose and septum are next dealt with. Subsequently the nose should be lightly packed with strips of gauze and the parts allowed to fall back into their original position; no sutures are required.

Two other methods may be mentioned. The nasal fossa may be opened from the side through an incision in the fold between the nose and cheek. The incision is deepened to the bone, the alar cartilages divided, the nasal bone cut through with saw or pliers and the nostril thus opened. A good view of the interior of the nose is obtained, but the operation appears to have no advantage over the one above described.

Occasionally, when the growth is attached to the upper and anterior part of the septum, as in one case which I have seen, the best view of the disease is obtained by splitting the nose vertically down its centre. This operation leaves an ugly scar and fortunately is very rarely required.

2. **Growths affecting the ethmoidal region** are the most unfavourably situated for operation. They may have spread deeply into the bones and involved the ethmoidal cells and frontal sinus or have even spread through the cribriform plate without any obvious indication. The grave risks attached to an extensive operation in this region must also be borne in

¹ *Journ. of Laryngol.*, 1903, xviii. p. 398.

mind. When removal is determined upon it may be carried out either through the natural passages or through an external opening.

(a) **Through the natural passages.** This operation consists in tearing away the mass of the growth with ordinary polypus forceps, followed by subsequent curettement of the parts. I have treated one case in this way and the patient remained free from recurrence for two years. Then the disease recurred, and the patient refusing further operation, it soon proved fatal. When the growth is small and there is no apparent deep extension an operation of this kind probably affords as good a chance of success as any other. Owing to its cellular nature the ethmoidal region can be freely broken down beyond the apparent limits of the growth and thus free removal is sometimes possible. If there are signs that the growth has already spread into the nasal bones, into the orbit, or into the cranial cavity, no operation should be undertaken. The details of this operation are similar to those of the operation already described for severe cases of nasal polypus (see page 194).

(b) **External operation.** Ollier's method gives the best access to this region. The incision is made from the lower border of the nasal bone on one side upwards round the inner angle of the orbit to the eyebrow, across the bridge of the nose and downwards to a corresponding point on the opposite side. The incision is made right to the bone, a fine saw is applied to the bridge of the nose with its blade flat against the forehead, and the bones are sawn through in the plane of the incision. The nose can then be pulled forward and the upper region of the nasal cavity at once comes into view. The growth can then be torn, scraped or cut away. When the nose is replaced and carefully stitched into position little deformity remains, and there is no danger of the nose sloughing because the incisions are so planned that the main blood supply of the organ is left intact.

3. **Growths involving the posterior part of the nose.** The best access to this region is obtained through the mouth, by splitting the soft palate and cutting away as much of the hard palate as necessary: an operation devised by Nélaton. A preliminary laryngotomy should be performed and the pharynx packed with a big sponge to prevent blood entering the larynx. The patient should be placed with the head hanging over the end of the table in such a position that a good light falls into the mouth, or reflected light may be used. The soft palate is split near the middle line and the incision carried forward on to the hard palate dividing all the tissues down to the bone. The two halves of the soft palate are then held aside by silk threads passed through the edges of the wound, and the soft parts are detached from the hard palate. As much of the bony palate is exposed and cut away with the chisel as is necessary to give a full view of the tumour. The growth is then removed, together with a sufficient margin of healthy tissue, by cutting all round it and detaching it from the underlying bone with periosteal elevators, or a small plate of bone may be gouged away. The bleeding is arrested, the wound carefully dried

and cauterized with a strong caustic such as fuming nitric acid. The wound in the palate is closed by a few sutures and union readily occurs.

Method of Partsch. Schäfer, in a report on five cases, recommends the method devised by Partsch. The incision for this operation commences opposite the second molar tooth and runs all round the gingivo-labial margin to the same tooth on the opposite side. The incision is carried to the bone, and the saw is then applied in the horizontal plane. The nasal septum is divided near the floor of the nose. This having been done, the hard palate and alveolar processes can be depressed like a flap. This procedure gives a good view of the tumour which can then be removed as above described.

Various other operations have been proposed for dealing with malignant disease in this situation, such as temporary resection and partial or complete removal of the upper jaw. For the details of these operations the reader is referred to surgical text-books. This much, however, may be said; if the growth be so extensive that it cannot be dealt with by the simpler methods already described, the larger operations are not likely to be successful. It is doubtful if they are ever worth undertaking.

4. **Tumours of the Accessory Sinuses.** Malignant disease of the antrum, when not too far advanced, may sometimes be successfully treated by partial or complete removal of the superior maxilla. Growths springing from the anterior wall are the most favourably situated, as the diagnosis is more readily made in the earlier stages, and the parts can be more freely removed. Growths involving the frontal sinus have sometimes been treated surgically, the sinus being freely exposed through an external incision (see Chap. XXI.), but no successful case has as yet been recorded. Growths in the other accessory sinuses are probably quite beyond the reach of surgery.

Palliative Treatment. When extirpation of the growth is impossible all that can be done is to relieve the patient's worst symptoms. With the object of starving the tumour Dawbarn has suggested ligature and excision of both external carotid arteries, but this seems a severe procedure for merely temporary benefit. Pain and headache must be controlled with opium; the nose kept as clean as possible by syringing with solutions of boracic acid, sanitas, peroxide of hydrogen, or other mild antiseptics. Insufflations of orthoform with iodoform or boracic acid in powder often give great relief. Packing the nose with strips of iodoform or cyanide gauze is sometimes useful, especially when there is a tendency to bleeding. If the growth spread down into the pharynx, or fill the mouth, tracheotomy may become necessary, and swallowing may be so difficult as to require the use of a feeding tube. These distressing symptoms may, however, be relieved by simply breaking off a piece of the growth with the fingers. I have seen cases apparently requiring an urgent tracheotomy in which immediate relief was afforded by spontaneous sloughing of a portion of the growth, and rather than add to the distress of the patient by performing tracheotomy I should prefer to break away

a piece of the growth, an easy proceeding and apparently without much danger.

The following works may be consulted :

TRAUTMAN, *Archiv für Laryngol.*, 1905, xvii. p. 386.

FINDER. *Archiv für Laryngol.*, 1896, v. p. 302.

DONOGÁNY and LÉNÁRT. *Archiv für Laryngol.*, 1904, xv. p. 586.

CITELLI and CALAMIDA. *Archiv für Laryngol.*, 1902, xii. p. 273.

Frontal Sinus.

IWANOFF. *Archiv für Laryngol.*, 1904, xvi. p. 520.

ONODI and BARTHA. *Archiv für Laryngol.*, 1903, xv. p. 167.

Of Antrum.

KIRSCHNER. *Archiv für Laryngol.*, 1903, xv. p. 1.

WENDELL PHILLIPS. *Journ. of Laryngol.*, 1898, xiii. p. 325.

Sphenoidal Sinus.

CITELLI. *Archiv für Laryngol.*, 1903, xv. p. 252.

RECURRING FIBROMA OF THE NASO-PHARYNX.

These tumours are nearly always found in males between the ages of 15 and 25. They are attached by a broad base, usually to the body of the sphenoid, and thence extend forward into the nose or backwards into the throat. The neighbouring bones may become absorbed and the tumours extend to the cerebral cavity, to the antrum or to other accessory sinuses. They are always single, bleed readily when touched, and tend to recur after removal. Some of the tumours are pure fibromata, others resemble sarcomata, and it is often impossible to say in which group a particular tumour should be classed.

Moritz Schmidt found 25 cases of fibroma in 58,000 patients: during this time he saw malignant disease in the post-nasal space in only 6 instances. In two sets of statistics quoted by Morell Mackenzie, comprising over 100 cases in all, with one exception the patient was a male under the age of 25.

Symptoms. The earliest symptom is gradually increasing nasal obstruction with its consequences. Deafness and middle ear catarrh may arise from pressure upon the Eustachian tubes; the voice is markedly affected; and there is generally much purulent or muco-purulent nasal secretion. Epistaxis is common and often severe: it may reduce the patient to an extremely anaemic condition. Thus the symptoms are similar to those of adenoid growths, but much more pronounced. A curious and not infrequent symptom is excessive drowsiness, the patient falling asleep and snoring loudly even whilst standing or whilst following his occupation. Mackenzie quotes a case of a barber who whilst following his occupation fell asleep and dropped a hot curling iron on to his client's chin.

If the growth spread down into the pharynx it may become visible

below the soft palate, which is pressed forward and downward, and may give rise to dyspnoea and dysphagia. If the growth spread forwards into the nose or accessory cavities it may cause expansion of the face, giving rise to the deformity known as "frog face"; if it spread into the antrum it may cause a tumour of one cheek. On examination with the post-nasal mirror the growth can be readily seen: it is usually pale, white, or yellowish in colour, but rarely may be red and vascular. If the growth be small its point of attachment may often be recognised. Digital examination must never be omitted. The hard firm nature of the growth, its broad base and any probable extensions can thus be made out. A soft growth bleeding readily with the touch of the finger, with ulcerated or sloughing surface, is probably a sarcoma.

Diagnosis. If the tumour be examined with the mirror and by digital examination, it can hardly be mistaken for any other affection; although



FIG. 102.—FIBROMA FROM POST-NASAL SPACE.

it may be impossible to distinguish between pure fibrous tumours and fibro-sarcomata, even by microscopical examination. An endeavour must be made to ascertain the extent of the growth. Signs of involvement of the cerebral cavity and of the antrum must be carefully sought for. Severe headaches, excessive drowsiness, vomiting, optic neuritis or atrophy, are indications of cerebral pressure.

Pathology. The ordinary fibroma is exceedingly dense and consists of concentric layers of fibrous tissue. The vessels are numerous and thick-walled. Many tumours contain collections of round or spindle-cells, and the growth in places may resemble sarcoma microscopically, but without any signs of clinical malignancy.

Prognosis. When a small hard growth is present, the prognosis is good, provided free removal is carried out. There was a general impression amongst the older writers, with which Morell Mackenzie and Macdonald agree, that these growths showed a disposition to atrophy at, or after, the age of 25. They asserted that if the growth could be kept in check by repeated removal its spontaneous arrest at this age might be expected. Without subscribing to the truth of this assertion, it is at least certain that simple operations such as removal with a snare may succeed ultimately, although one or two recurrences may occur. In sarcoma the prognosis is extremely unfavourable. It is almost impossible even by extensive

operation at the earliest possible stage to eradicate a growth from this region; moreover, the glands on both sides of the neck are usually involved at an early period.

Treatment. If the growth be small and hard, with no sign of involvement of the bones or of extension to the neighbouring cavities, the simplest and best treatment is removal with the snare. A strong instrument threaded with a stout wire must be used. If owing to the size of the growth there is some difficulty in passing the wire loop through the nose, the following manoeuvre may be practised:—A small gum-elastic catheter is pushed down the nose until it appears in the post-nasal space. It is grasped with forceps and pulled forwards into the mouth, a piece of silk is attached and drawn through into the nose. The ends of a stout wire loop are now attached to the silk and drawn into the nose, whilst the loop is pushed back into the naso-pharynx and carefully adjusted by the fingers as close as possible round the base of the tumour. The free ends of the wire are now threaded and attached to a snare in the usual way. The growth must be slowly cut through to avoid bleeding. If the loop be hitched well up round its base the entire growth will often be enucleated. In this way I have successfully removed two growths, one from a female of 22: in neither case has recurrence taken place within two years. The method is almost without danger, and is applicable to all except the largest growths.

If a very large tumour be present, extending forward into the nose, the best plan will be to expose it by the method introduced by Nélaton. This consists in splitting the soft palate, prolonging the incision on to the hard palate, turning aside the soft parts, and chiselling away some of the bone beneath. The operation is similar to that for malignant disease in this region, and has already been described (see p. 237). When the growth involves the accessory sinuses, various operations must be devised to meet the particular circumstances; these often require total or partial resection of the upper jaw.¹ When the cerebral cavity is involved no radical operation is possible.

Various other methods, now mostly obsolete, have from time to time been advocated. They were designed to avoid hæmorrhage, the risk of which has been greatly exaggerated. Moritz Schmidt strongly recommends electrolysis, a slow and unsatisfactory method. Evulsion piecemeal with forceps has also its advocates. The methods of injecting strong caustic solutions and of strangulation by ligature probably belong entirely to the past.

The following works may be consulted:

QUINLAN. *Laryngoscope*, 1902, xii. p. 840 (gives full references).

Discussions at Laryngol. Soc. of London., *Journ. of Laryngol.*, 1900, xv. pp. 77 and 155, and *Journ. of Laryngol.*, 1896, x. p. 326.

HENGST. *Journal of Laryngol.*, 1899, xiv. p. 100.

¹ See interesting case reported by Tilley in which four successive operations were performed. *Journ. of Laryng.*, 1903, xviii. p. 45.

SCHÄFER. Journ. of Laryngol., 1902, xvii. p. 155.

BOWLBY. Lancet, 1895, ii. p. 913.

KIJEWSKI and WROBLEWSKI. Archiv für Laryngol., 1895, ii. p. 78.

DEMPSEY. Journ. of Laryngol., 1902, xvii. p. 439.

HOLMES. Journ. of Laryngol., 1902, xvii. p. 399.

Also the articles in Morell Mackenzie's, Greville MacDonald's, and Moritz Schmidt's books.

CHAPTER XIV.

THE NASAL NEUROSES. HAY FEVER. ASTHMA.

INTRODUCTION.

THE nasal reflex neuroses form a much discussed but little understood group of affections. Hay fever was first described by Bostock in 1819, and the relationship of asthma to nasal diseases was pointed out by Trousseau. Voltolini, in 1871, first showed that asthma could be cured by the application of the galvano-cautery to the nose, and a series of similar observations soon followed, but it remained for Hack in 1882 to direct general attention to this subject. He greatly extended the province of the nasal reflexes, making it include such various affections as neuralgia, headache, cough, vasomotor skin troubles, epilepsy, chorea, etc., and started a controversy which has continued ever since and still remains unsettled. The subject is extremely important, there are numerous theories, but great difficulties in obtaining trustworthy data; hence the present unsatisfactory state of the controversy.

A **pathological reflex** may be regarded as a reflex due to a stimulus which will act only if the normal resisting power be lowered or removed. The increased excitability of the reflex mechanism may be due to some individual susceptibility to particular stimuli, to undue acuteness of the peripheral nerve endings, or to instability of the nerve centres. The last is probably a constant factor and is shown in many ways. The subjects of these affections for the most part belong to the leisured classes, and inherit a tendency to neurotic affections. Most of the severer cases suffer from neurasthenia, hysteria, or allied neurosis. Many patients are affected only when run down, after a prostrating illness, or when overworked or worried. It is probable that sometimes there is an undue excitability of the afferent nerve endings. When once a reflex disturbance has been produced it can be more easily excited again. Thus in persons predisposed to hay fever, which is usually excited by the irritation of hay pollen on the nasal mucosa, a paroxysm of sneezing may be set up by the stimulus of a strong light falling on the retina; and asthma, even if usually of nasal origin, may be excited in a predisposed person by disturbances in other organs; for instance, in the stomach. It is obvious that the more sensitive the

afferent nerve endings and the more unstable the nerve centres, the greater will be the effect produced by a given stimulus, and the smaller will be the stimulus necessary to excite a reflex.

Etiology of Nasal Reflexes. The supposed exciting causes require some consideration. The stimulus may be conveyed from the nose to the nerve centres either through the nerves of ordinary sensation, the first and second divisions of the fifth nerve, or through the nerve of special sense—the olfactory nerve. Amongst the causes affecting the peripheral nerve endings in the nose may be noted:—

(1) Various affections, such as hypertrophic rhinitis, polypus, abnormalities of the septum, synechia, foreign bodies in the nose, etc. Almost any nasal disease or operation, such as the application of the galvano-cautery, may irritate the tender nerve endings, and, when other circumstances are favourable, set up reflex disturbances. The exact manner in which these affections act is unknown. The nerve endings may be irritated in various ways, such as rubbing, pressure or contact. Thus a polypus, and especially one which can change its place, may rub against the nasal mucous membrane, or it may produce pressure by the transitory swelling which so frequently occurs. Spurs on the septum may come into contact with swollen turbinates and produce pressure. Inflammatory affections of the nose may excite the afferent nerve endings either by producing pressure on them or by chemical alterations in the nasal secretion. Synechia may perhaps pull upon the nerve endings; foreign bodies and rhinoliths may produce rubbing or pressure.

(2) The most common exciting cause is the presence of impurities in the inspired air—thus the pollen of hay, of flowering grasses or of other plants, the bloom of peaches, etc., are fruitful causes of the affection known as “hay fever”; smoke or dust-laden air may produce similar effects.

(3) Thermal changes; exposure to cold, to heat, or to more or less sudden alterations of temperature are frequently ascribed as causes.

(4) Stimulation of the olfactory nerve; for example, various smells, and, strangely enough, often pleasant smells such as the odour of roses, violets, peaches, etc., may produce an attack of sneezing in the predisposed. Exhalations from various animals, such as cats and horses, probably come into the same category.

Point of Origin. Definite areas have been suggested as the site of origin for reflex affections. Hack considered that reflex disturbances originated in the anterior ends of the inferior turbinates. Later he added that they might also arise from the posterior ends of the inferior turbinates and from the middle turbinates. Lewy discovered numerous thick nerve branches just below the surface of hypertrophic inferior turbinates, and considered them the cause of the increased reflex irritability. Heryng considered that most reflexes originated in the posterior part of the nasal septum: almost every part of the nose has been accused at some time. Francis claims that there is an area in the upper and posterior part of

the septum above the centre of the middle turbinate which is intimately related to asthma. Torstenson from observations on 400 cases of asthma stated that there was a sensitive spot in this region. It is true, as already shown, that irritation of different parts of the nose produces referred pains in definite regions (see p. 88), but no particular nasal area can be certainly designated in connection with hay fever, and it is probable that it may arise from a stimulus applied to any part of the nasal mucous membrane. That any definite area is associated with asthma is also open to doubt.

Mode of Action. The manner in which the exciting causes act is unknown. Hack considered that the first effect was swelling of the inferior turbinates, but there is not sufficient evidence to support this view. All that can be said is that a centripetal impulse, started in either the olfactory nerve or the nerve of ordinary sensation, travels up to the nerve centres, and thence through unknown connections passes into motor, vaso-motor, or secretory channels, and may affect the most distant organs. Only in a few instances have direct experiments yielded positive results. Thus Kratschmer showed that irritation of the nose could produce closure of the glottis and bronchial spasm. Cough may be produced by touching the nasal mucous membrane with a probe. Lastly, Brodie and Dixon state that asthma may be produced by stimulating the nasal mucous membrane, and that the efferent impulses travel down the vagus nerves (see later).

Classification. The reflex nasal neuroses may be divided into three distinct sets. First *those in which the afferent impulses originate, and the efferent impulses end in the nose.* This group comprises the affections known as vasomotor rhinitis, hay fever, paroxysmal sneezing and rhinorrhoea. These are all closely allied, if not identical, affections, and there is little doubt that they result from a true nasal reflex neurosis. The whole symptom-complex, the sneezing, the profuse watery discharge, the vaso-motor dilatation, can be produced physiologically by applying a sufficiently strong stimulus to the nose.

. The second group includes *those affections in which the afferent impulses originate in the nose and the efferent impulses fall upon other organs.* Chief among these is asthma, which will be considered in a special article. Spasm and paresis of the adductor muscles of the larynx may be closely associated with disease of the nose, but it is extremely doubtful if they depend on a nervous reflex. There is often a direct continuity of inflammation or an alteration in the inspired air as the result of the nasal affection. Various cardiac neuroses have been referred to the nose on the strength of Kratschmer's work, which apparently showed that irritation of the nasal mucous membrane slowed the heart beat and raised the blood pressure. Kassel has recorded a case of persistent tachycardia due to a spur on the septum. Touching the spur with a probe at once excited the tachycardia, which was immediately cut short by applying cocaine and permanently cured by removing the spur. Kratschmer's experiments

were directly negated by those of Guder, who irritated the nasal mucous membrane in 43 subjects and tested the results with the sphygmograph. Perhaps nasal affections may sometimes act upon the heart in other ways, for example, by their effect upon the general nutrition: or obstructed nasal respiration may directly produce circulatory disturbances.

Various eye troubles—blepharo-spasm, squint, asthenopia, and errors of accommodation, various pupil changes, hyper-secretion of tears, hyperaesthesia of the retina, amblyopia, exophthalmos and conjunctivitis, have all been ascribed to reflex disturbances arising in the nose. This relationship is open to grave doubt. It is more likely that some of the above mentioned eye affections depend upon the direct connections between the blood and lymph circulation of the nose and eyes, or upon the direct continuity of the conjunctiva with the nasal mucous membrane through the tear duct, or upon alterations of the general health. Amongst other supposed nasal neuroses may be mentioned epilepsy,¹ chorea, Graves' disease, migraine, etc., for none of which is there sufficient ground to blame the nose. Lacroix relates a case of severe vertigo in a woman cured by removing nasal polypi. The direct connection between nasal affections and headache, neuralgia, catarrh of the larynx, trachea and bronchi, has already been pointed out (see page 90). Nasal disease may undoubtedly be one of the factors in the causation of these affections, but they are not reflex disturbances. Nocturnal enuresis often depends in part upon nasal obstruction; it is probably not a reflex but a direct consequence of the blood condition resulting from impeded nasal respiration, as already pointed out (see page 72). Hobbs² relates two cases of persistent priapism cured by applying cocaine to the nose. He ascribes the cure to the reduction of the nasal stenosis.

A third group of nasal neuroses has also been described; namely, *those in which the nose is reflexly affected by disturbances occurring in other organs*. Thus persistent sneezing has been cured by correcting defects of accommodation.³ Affections of other organs undoubtedly influence nasal disease, but nothing is known to warrant their being considered as reflex neuroses.

Relation of Nasal Disease to Reflex Effect. As already said, any part of the nasal mucous membrane and any affection of the nose may apparently give rise to any of the various reflex disturbances. It is impossible to say from the nature of the nasal affection what, if any, reflex disturbance will be set up. Further, it is impossible to discover anything suggestive of its nasal origin in the nature of the reflex neurosis itself, in its origin,

¹ For references see chaps. iv. and xxiv. Jousset mentions one case in which the fits were preceded by a nasal aura—pricking in the nose and sneezing—and two which were cured by removing nasal obstructions.

² *Journ. Amer. Med. Assoc.*, 1897, xxviii. p. 789.

³ Gould, *Philad. Med. News*, 1892, lx. p. 300, and Herron, *Internat. Centralb. für Laryngol.*, x. p. 287.

in its course, or in its symptoms. Asthma of nasal origin is exactly similar in its history, course, paroxysms, etc., to asthma arising from other cause.

The second group of reflexes, those in which disturbances are apparently set up in distant organs by stimuli originating in the nose, require the most careful consideration. Before deciding that a disease is a reflex nasal neurosis, the evidence should be very carefully weighed.

Evidences of a Nasal Reflex. (1) The existence of a nasal affection must be ascertained. The nose must be examined for polypus, hypertrophies of the turbinates, irregularities of the septum, foreign bodies, etc. The nasal affection may not cause inconvenience, and may therefore be unsuspected by the patient, or slight symptoms may be elicited by questioning. Even if some abnormality be found it may, of course, be merely a coincidence; it does not necessarily follow that it is the cause of the trouble.

(2) There may be a nasal aura. For example, a tickling or pricking sensation in the nose, itching, or an attack of paroxysmal sneezing may precede, alternate with, or be associated with asthma.

(3) The supposed reflex disturbances may be excited by irritating the nasal mucous membrane. But even if positive results be obtained they are not quite conclusive. When the nervous system is unduly excitable, stimuli applied to the most different nerves may excite a reflex nervous explosion, the exact expression of which will vary with the individual patient. Thus, if a patient be subject to epilepsy, a fit may be produced; if to asthma, an asthmatic attack ensues, and so on, whatever nerve be stimulated.

(4) A more valuable experiment can be carried out if a patient come under observation whilst actually suffering from the disturbance. Thus if a patient be seen during an asthmatic attack, and if the spasm can be immediately cut short by applying cocaine to the nose, the result seems conclusive. A negative result may also be considered of considerable weight. This experiment is often successful in asthma, and almost invariably so in paroxysmal rhinorrhoea. It is, perhaps, the best proof that has been produced, that asthma may originate in a reflex disturbance commencing in the nose, although it cannot be held absolutely conclusive. Thus the cure of persistent priapism, already referred to, by applying cocaine to the nose may have been due to the general effect of the drug.

(5) The experiment which is usually taken as convincing is the effect of nasal treatment. If the patient is found to be suffering from some severe or trifling disease in the nose, and if treatment of this is followed by cessation of the presumed reflex disturbances, the cure is at once claimed as the result of nasal treatment. This is the old fallacy of *post hoc, ergo propter hoc*. In affections of this class the results of treatment are very fallacious. If the nerve centres are being excited by a stimulus, the effect can usually be lessened or even stopped by applying another different stimulus. Thus the cure of a reflex neurosis may mean simply

that another stimulus has been introduced, and not that the causal stimulus has been removed. Hysteria has been cured by cauterizing the clitoris, sciatica by cauterizing the auricle, and asthma by dilating the sphincter ani, although no one would pretend that the causes of these affections were located in the regions treated. Further, the results of treatment may be due to hypnotic suggestion, especially when patients have been encouraged to expect a cure. Many "cures" are thus explicable, and "most brilliant" published results are often nothing more than too early publications. The so-called cures have been of short duration, the affection has subsequently returned in an even more severe form, and the short interval of freedom has been only too dearly purchased by the loss of some important nasal structure and interference with the functions of the nose.

A further error may arise when reasoning from the results of nasal treatment upon affections of the eye, ear, or larynx. Affections of these organs may undoubtedly be cured by nasal treatment, but the result may be explained by removal of the cause, by alterations in the inspired air, alterations in the blood or in the circulation, and by the beneficial effect upon the general health. Thus a cure in no way proves that the affection was a reflex nervous disorder starting in the nose.

In the third group of reflexes arguments based on the results of treatment are even more inconclusive. Relief or cure may quite well depend upon changes produced in the blood, or upon improvement in the general health. For instance, toxic absorption, anaemia, or general debility due to constipation, to gastric disorders, etc., may have great influence in keeping up nasal disease, and their removal may aid in its cure. This result affords no ground for regarding the nasal disease as a reflex disturbance originating in the stomach or alimentary canal.

Prognosis. In genuine reflex disturbance a speedy and complete cure may be expected from nasal treatment, provided that the affection has not been of too long duration, that secondary organic changes have not been produced, and that the patient be not suffering from too grave a form of hysteria or neurasthenia. Recurrences, however, may be expected if the cause returns. If the patient suffer from severe neurasthenia or hysteria, the affection may prove very obstinate and the cure depend mainly upon general treatment. It is often inadvisable to undertake local treatment at all, until the general condition has been improved, when it may be unnecessary. Also, it is obvious that if a reflex disturbance has been of long duration, anatomical changes may have taken place in the affected organ and may hinder the cure. Thus, asthma, even if it originate in the nose, may cause emphysema of the lungs and a complete cure will not follow nasal treatment. It also appears that when definite individual idiosyncrasies exist for certain exciting causes, *e.g.* for the smell of roses, a cure may be extremely difficult unless the cause can be avoided.

Treatment. When a symptom is presumably of reflex origin local treatment should be conducted upon the following principles. (1)

When possible, the exciting cause should be removed: *e.g.* patients who suffer from genuine hay fever should avoid the country when the grasses are flowering. (2) Disease or abnormality of the nose should be treated, as it seems possible that almost any morbid condition may excite a reflex. (3) When a definite exciting cause cannot be discovered or cannot be removed, and when no definite abnormality can be discovered in the nose, Hack laid down the rule that the galvano-cautery should be applied to the anterior ends of the inferior turbinates, which he regarded as the part originating the reflex. He claimed brilliant results from removing or destroying these structures. His followers found that it was necessary to extend this area until almost the entire nose has been operated on. These proceedings led to a large amount of scarring and of destruction of the nasal mucous membrane. Ziem and Heryng protested against this, and as it gradually came to be recognised that the galvano-cautery might not only fail to effect a cure but might do far more harm than good, a marked reaction set in. The treatment of the healthy nose has, however, never been completely abandoned, and lately it has been strongly recommended by Francis, the septum being the selected part. This method will be discussed in greater detail in connection with the treatment of asthma and paroxysmal sneezing.

Palliative Treatment. During the actual attacks palliative remedies are often necessary, especially in an affection like asthma. They comprise soothing applications to the nose such as sprays containing menthol or cocaine, the use of sedative inhalations, or the administration of general sedatives such as hypodermic injections of morphia. It must be borne in mind that these remedies are merely palliative, and often tend to aggravate rather than to cure the affections. They must only be used under constant medical supervision and never be entrusted to the patient.

Lastly, **general treatment** is very important. Any constitutional disorder should be treated as far as possible. The patient should be placed in the best hygienic conditions. Change of air or a course of treatment at a hydropathic resort is often of the greatest benefit. The patient should avoid nervous excitement, over-exertion and fatigue. The diet should be regulated and consist of a plentiful supply of plain, light food. Alcohol should be taken in small quantities or altogether avoided; tobacco should be forbidden. Tonics, especially strychnine, will often do good. In the worst cases the Weir-Mitchell treatment or some modification of it may be necessary.

References.

- LEWY. *Archiv für Laryngol.*, 1902, xii. p. 53.
 LACROIX. *Archives internat. de Laryngol.*, 1898, xi. p. 471; (*Ref.*) *Journ. of Laryngol.*, 1899, xiv. p. 210.
 GUDER. *Annales des Maladies de l'Oreille, etc.*, 1898, xxiv. p. 39.
 KASSEL. *Archiv für Laryngol.*, 1902, xiii. p. 298.
 BUKOFZER. *Archiv für Laryngol.*, 1903, xiv. p. 500.

HAY FEVER. ROSE FEVER. PAROXYSMAL RHINORRHOEA. VASO-MOTOR RHINITIS.

The affections comprised under these and various other names may be best considered as one. The exciting cause may vary in individual instances, or may be unknown: the main features of the disease are constant. It is undoubtedly a reflex disturbance starting from and terminating in the nasal mucous membrane, and fulfils the conditions above postulated. The symptoms can be produced by applying mechanical or other irritants to the nasal mucosa. They can be arrested temporarily by the application of cocaine to the nasal mucous membrane and can usually be cured by treatment directed to the nose alone.

As a rule the stimulus is conveyed by the nerves of ordinary sensation, that is, by the branches of the first and second divisions of the fifth nerve. Occasionally it seems that the afferent impulse may travel up the olfactory nerve or even the optic nerve, for the affection may be excited by various odours, or by strong sunlight falling on the retina: or the excitability of the central nervous system may be so exalted that nervous discharges apparently may occur without any exciting cause.

Exciting Causes. The most frequent exciting cause is the pollen of certain grasses, and especially of hay, whence the affection derives its common name. The patient is quite well under ordinary circumstances, but directly he is exposed to air laden with hay pollen a violent paroxysm of sneezing commences, which will pass off in a few hours if he be removed from the pernicious influence. Less commonly, the pollen of other grasses or plants produces a similar effect. Some patients ascribe their attacks to various odours, such as that of roses—rose fever—or to the bloom of peaches, etc. The exhalations of certain animals, horses and cats, and especially of certain fabrics, such as various kinds of mats or carpets, are the apparent exciting cause of attacks in others. In another large group of cases the paroxysms are brought on by changes in temperature, such as passing from a warm into a cold room, or vice versa. The inhalation of dusty air is a frequent cause. It is possible that the affection may be brought on by disease of the nose, as for example by a polypus which constantly changes its position and thus rubs the mucous membrane, or by the pressure of a septal spur upon the turbinates or outer wall of the nose. In many patients the attacks occur at regular or irregular intervals without any appreciable exciting cause. These patients usually suffer more in the winter than in the summer and more in cold and damp than in warm, dry climates. A cause which is at other times ineffective may bring on an attack when the patient is in a susceptible condition, thus strong sunlight may excite sneezing in a patient during the hay fever season but not at other times.

Predisposing Causes. Local. Amongst these may be enumerated any disease or abnormality of the nose, such as chronic or hypertrophic

rhinitis, deflected septum, adenoids, etc. Their mode of action is doubtful; they may promote a tendency to catarrh and thus render the nerve endings more sensitive. On the other hand, swelling or oedema of the nasal mucous membrane may be the consequence and not the cause of the affection. Generally the nose shows no sign of disease. It is often assumed that there always exists a hypersensitive condition of the nasal mucous membrane, but no definite evidence has as yet been adduced in support. To test this point the nose may be touched with a probe or stimulated by the inhalation of ammonia as recommended by Fränkel.

General. Amongst general causes may be noted neurasthenia, hysteria, or a generally neurotic disposition. These conditions are probably in greater or less degree a constant accompaniment and predisposing cause of the affection, even when a definite exciting cause, such as hay pollen, is also necessary. Many patients have an inherited predisposition to nervous affections as evidenced by various neuroses occurring in different members of the family. The large bulk of the cases are drawn from the upper, more leisured classes, from brain workers and town dwellers. Morell Mackenzie went so far as to state that hay fever was unknown in the ordinary hospital class of patient. It is extremely rare amongst the rustic population and in children. Cathcart¹ has recorded a case in a child aged nine years, the youngest patient so far observed. The neurotic element is sometimes strikingly shown, as in the well-known case of a sufferer from rose fever who was violently affected by the sight of artificial roses. Again, many patients suffer from hay fever after severe illnesses, or when worried or debilitated, and recover as the general health improves. The most striking benefit often results from general treatment only.

Symptoms. The symptoms of hay fever are very characteristic. They consist of violent attacks of sneezing with profuse watery discharge from the nose, nasal obstruction, and its associated symptoms. The sneezing attacks commence immediately on exposure to the exciting cause and slowly subside after removal from it. The nose becomes obstructed, the eyes suffused, the skin of the nose and eyelids appears red and swollen, and the patient's whole head seems to be congested. There is profuse watery discharge from the nose which may soak many handkerchiefs, the eyes water and the tears overflow on the cheek. The patient suffers from headache and general malaise: if the attack continues long he may be quite prostrated. When no definite exciting cause is present periodical exacerbations may occur. In a very common form, the paroxysms come on every morning on waking or rising, and last from a few minutes up to an hour or several hours. They occur only in the morning, or in the morning and evening, or, rarely, may last all day. The attacks may recur every day for a time, then at intervals

¹ *Journ. of Laryng.*, 1902, xii. p. 255.

of days or weeks, and later again become daily. The sneezing may be the most prominent symptom, or nasal obstruction associated with profuse watery discharge may occur with very little sneezing. In severe and long continued cases there is considerable anaemia and general debility. During a severe attack a patient is quite incapacitated from following any occupation: thus the affection is by no means the trifling inconvenience it is often considered. I have seen patients who after exposure to dust or to hay pollen have suffered so severely that they have been utterly prostrate, and have been compelled to confine themselves to a darkened room from 24 to 36 hours at a stretch. During the hay fever season such a patient may lose 1-2 stones in weight and may take months to regain his general health. In rare cases true hay fever may increase in severity and duration year by year until ultimately it may last from May till October. The more severe attacks are frequently complicated by asthma.

The **prognosis** on the whole is favourable. By nasal treatment alone, or by a conjunction of local and general measures, the disease may be arrested in the large majority of cases, although it is impossible to predict with certainty how severe the treatment must be or for how long it must be continued. The milder measures may apparently effect a cure, but the disease only too commonly recurs and renders further treatment necessary.

Treatment. The Removal of the Exciting Cause. When the affection is due to a definite exciting cause, the patient should be removed from its influence whenever this is possible. Thus if a patient who suffers from genuine hay fever can spend that portion of the year in which he is affected at the seaside, or better still on the sea, or in places where there are no grasses, such as in the Island of Heligoland, no further treatment is required. Many severe sufferers remain quite free in the Tropics.¹ Similar remarks apply to the rare cases of rose fever. When, as frequently happens, it is impossible to follow this advice owing to the patient's circumstances or to the great inconvenience that would be caused, other measures must be adopted.

The Removal of the Predisposing Local Cause. This consists in the treatment of any definite disease or abnormality of the nose, that is, of any affection which gives rise to nasal symptoms apart from those now under discussion. Thus I should certainly not advocate the removal of a small spur unless it was producing obstruction, although this has frequently been done for the hay fever alone and the usual "most brilliant" results have been claimed for it. It is doubtful how much of the success of such operations depended upon the removal of the spur itself and how much depended upon the mental effects. Any improvement

¹ This at least applies to Central America, West Africa and India but I am indebted to a correspondent in Queensland for the information that hay fever is not unknown there (Dr. Dunlop, Ipswich, Queensland).

thus obtained is usually evanescent. When, on the other hand, such diseases as polypus, polypoid disease of the middle turbinate, or hypertrophy of the inferior turbinate, are radically treated, permanent results may follow. This treatment may be advantageously combined with general measures.

Constitutional Treatment. A most important part of the treatment consists in the removal of the general predisposing causes. If a patient suffer from severe neurasthenia, he must undergo a thorough course of general treatment before local measures can be adopted with success. The attempt to cure rhinorrhoea associated with profound neurasthenia by local means, such as the application of the cautery, without previously improving the general health, will do far more harm than good: it may so aggravate the patient's general condition that even the local troubles will be worse than before. For the exact measures to be adopted recourse must be had to text-books on general medicine. Sometimes simple tonics combined with plenty of good food and change of air to a bracing seaside or mountain resort will suffice. Occasionally the Weir-Mitchell treatment may be necessary. Lermoyez strongly recommends the internal administration of strychnine and atropine in combination: he considers this preferable to any form of local treatment.

Application of the Cautery. In this affection it is, I think, not only justifiable but necessary to treat the nose locally even if no local disease or abnormality can be discovered. The symptoms so obviously depend upon a nasal reflex that if the exciting cause cannot be discovered or removed, and if the general condition of the patient be good, nasal treatment should be carried out. The treatment is entirely empirical, and it is a little difficult to lay down definite rules. In my opinion the best method in the first instance is the cautious application of the galvano-cautery. Under cocaine anaesthesia one or two linear cauterizations should be made along each inferior turbinate. The effects should be carefully observed: if improvement occurs the treatment should be repeated until a cure is apparently obtained, or until no further benefit results. When this method fails the cautery may be applied in a similar way to the mucous membrane covering the upper part of the septum opposite the anterior end or the centre of the middle turbinate. This area often appears unduly sensitive and for this reason many surgeons have selected it primarily for cauterization. If preferred, chemical caustics, especially the trichlor-acetic acid, may be applied instead of the galvano-cautery, but they possess no special advantage. The above measures will usually effect a cure in the milder, and often in the more severe, forms of the affection.

Turbinectomy. The question next arises what should be done in the worst cases and when all other treatment fails. In these circumstances I have not hesitated to resort to more severe measures including complete extirpation of the inferior turbinates, of the middle turbinates, or even of both. Although these operations in hay fever are apparently never followed

by the dryness of the nose and throat which follows them when performed in other affections, still they are not to be adopted without due consideration and grave reason. Thus, one patient under my care had suffered from hay fever for 18 years. The duration of the annual attack gradually increased until, when he came under treatment, it lasted from May till October and completely incapacitated him. Exposure to dust, to bright sunlight, or to the pollen of flowers brought on an attack which confined him for 24 to 48 hours to a darkened room suffering agonies from complete nasal obstruction, profuse watery or bloodstained discharge and headache. The patient regularly lost a stone and a half to two stone in weight during the summer months. Applications of cocaine or adrenalin had ceased to give even temporary relief. Under these circumstances I advised the patient to have his inferior turbinates removed, assuring him that even if the sneezing attacks were not abolished he would at any rate be able to breathe through the nose and to expel the discharge which otherwise constantly dripped away. The result of the operation was better even than could be expected—not only have the nasal passages remained free but the hay fever itself has all but disappeared. In four cases I have removed not only both the inferior but also both the middle turbinates. One may be related as an example: a lady came under my care twelve years ago with ordinary paroxysmal rhinorrhoea, the attacks occurring periodically, generally in the morning without any definite exciting cause. Cocaine had been frequently used to relieve the attacks but was becoming ineffective. The application of the cautery to the inferior turbinates gave complete relief for six months. For the next four years the attacks were kept in check by occasional applications of the cautery. Then the disease returned in a more acute form and the cautery apparently had no effect even when freely applied under general anaesthesia. Operation under cocaine was extremely painful as owing to constant use the drug had lost its effect. Complete removal of the inferior turbinates was therefore advised. After this operation the patient remained well for a year. Then she returned stating that the rhinorrhoea was as bad as ever and that the nose was completely obstructed during the attacks. She complained especially of great pain and a bursting feeling across the bridge of the nose. As the patient was incapacitated I consented to remove one of the middle turbinates. She was much relieved by this operation and had no further trouble on that side of the nose, but continued to complain of all the old symptoms on the other side. The second middle turbinate was accordingly removed and now for four years the patient has remained completely well. In spite of the amount of mucous membrane which has been removed there is no trace of dryness either in the nose or in the upper air passages. This unexpected result seems to show that, in cases characterized by greatly increased secretion, much secreting tissue may be removed without a likelihood of causing harm. In three other cases I have removed first the inferior turbinates and later the middle turbinates with similar striking

results. It must be borne in mind that none of these operations were undertaken except as a last resort and only when the application of the cautery had been tried and entirely failed. I think these results show the justifiability of the proceeding, which I should not hesitate to recommend in other intractable cases. It is just possible that the results are due, not so much to the removal of an exciting cause as to the removal of the secreting organs. It is difficult to see how these patients should ever suffer again from the worst symptoms of hay fever—nasal obstruction and profuse discharge.

Palliative Treatment. Although I would strongly urge the methods of treatment above detailed, some other methods may be briefly considered. When the more severe measures are for any reason contra-indicated, and the milder measures have failed, palliative remedies must be tried. During the actual attack the patient will find great relief from confinement in a quiet, darkened room, and if it be necessary for him to go out in the sunlight he should wear smoked glasses. A word of caution must be uttered against the use of **Cocaine or suprarenal extracts**. These remedies may undoubtedly cut short an attack or give great relief to all the symptoms. The effect of both drugs however is only temporary. The shrinking of the mucous membrane is followed, after a short interval, by paralytic dilatation of the vessels, by increase of the nasal obstruction and by profuse discharge. The patient again has recourse to the drugs: and as they gradually lose their effect stronger and stronger doses are required. There is great danger of cocaine poisoning and of the patient acquiring the cocaine habit. Moreover, the local effect is disastrous. It is my invariable experience that these cases are the most difficult of all to treat and that in them the more severe measures alone offer a hope of success.

The internal use of **morphia** and **atropine** has the same objections. It undoubtedly gives relief, but it is obviously open to grave objection to allow patients to use dangerous remedies of this kind. The administration of bromides as recommended by Fränkel¹ is less objectionable but rarely does much good.

Other Methods. Mahu and Lermoyez recommend the passage through the nose of a current of superheated air. The air is passed through a series of tubes heated by electricity, and apparently exerts a mild caustic effect on the nasal mucosa. Mahu and Lermoyez have reported very favourably on it, but their experience has not been confirmed.

Holbrook Curtis² has tried to immunise patients against rose fever by hypodermic injections of sterilised infusion of roses. He reports 60 per cent. of cures by this method, but others who have tried the treatment were unable to confirm its value.

¹ *Berlin. klin. Woch.*, 1901, xxxviii. p. 389.

² *Journ. of Laryngology*, 1901, xvi. p. 649.

Dunbar claims that he has extracted a toxin from the pollen of certain grasses, which when instilled into the eyes or noses of susceptible patients will produce hay fever. By immunising horses against this toxin he has obtained an antitoxin (Pollanthin) which will at once cut short the artificially produced attack.

Semon¹ has experimented with Dunbar's serum. He found that the toxin produced hay fever symptoms in susceptible patients, but not in others, and that the antitoxin produced almost immediate relief. Thost² reports that he has tried the antitoxin in 47 cases of hay fever, with good results in 27 and with slight benefit in 12. Much further experience will be needed before the value of this treatment in hay fever can be estimated. At present there is not enough evidence to support the claims put forward for it.

References.

- THOST. *München. med. Woch.*, 1902, xlix. pp. 689, 749.
 LOCKARD. *Boston Med. and Surg. Journ.*, 1903, cxlviii. p. 59.
 MAHU. *Annales des Mal. de l'Oreille, etc.*, 1902, xviii., i. p. 481.
 BRADEN, KYLE, and others. *Journ. of Laryngol.*, 1903, xviii. p. 540.
 LERMOYEZ. *Annales des Mal. de l'Oreille, etc.*, 1899, xxv. p. 40.
 The reader may also consult the works of Morell Mackenzie, MacDonald, M. Schmidt, and the article by Jurasz in Heymann's *Handbuch der Laryngologie*.

ASTHMA.

Although Trousseau noted that asthma might be closely related to nasal disease, Voltolini, in 1871, was the first to state definitely that asthma could be cured by treating the nose. His observation was soon confirmed by other rhinologists such as Hänisch, Fränkel, Hack, Porter, Rumbold, Roe, and J. N. Mackenzie. Bosworth claimed that asthma was always caused by nasal obstruction. Morell Mackenzie, MacDonald, and most subsequent authors agreed that it was often dependent upon some nasal affection. The general opinion of rhinologists in 1899 was probably expressed, in a discussion at the Laryngological Society of London, by Semon, who said that a few cases of asthma could be cured by nasal treatment, a fair number relieved, but that the great majority were unaffected or actually made worse; although some claimed far better results.³ Among important recent contributions to this subject are, an experimental investigation by Brodie and Dixon,⁴ a monograph by Francis,⁵ and the discussion at the Oxford meeting of the British Medical Association.⁶

¹ *Brit. Med. Journ.*, 1903, i. p. 713.

² *München. med. Woch.*, 1903, p. 985.

³ *Proceedings Laryngological Society of London*, 1899, vi. p. 98.

⁴ *Transactions of the Pathological Society*, 1903, liv. p. 17.

⁵ *Asthma in Relation to the Nose*. London, 1903.

⁶ *British Medical Journal*, 1904, ii. p. 1231.

Pathology. The clinical features need not be described, asthma of nasal origin, assuming its existence, being in all respects similar to asthma arising from any other cause; but the pathogenesis must be briefly touched upon in order to explain the rationale of nasal treatment. It is probable that asthma is a spasmodic contraction of the bronchial muscular fibres. This theory accords best with the sudden onset and disappearance of the asthmatic seizure. It explains the immediate relief afforded by anti-spasmodic remedies such as morphia, lobelia, atropine, chloroform, and ether, although the last-named drug has a tendency to produce hyperaemia of the respiratory mucous membrane. The clinical history of a typical attack of asthma is extremely suggestive of a reflex spasm. Nearly all asthmatic patients show other definite signs of instability of the central nervous system.

The relationship of asthma to bronchitis is no doubt an intimate one, but there are many reasons for doubting that asthma is either a peculiar form of bronchitis or a stage in that affection. The very slight or almost total absence of secretion in the bronchi occasionally observed is hardly consistent with this theory, or with the alternative theory of a vasomotor dilatation. Bronchitis more often follows than precedes asthma, and the latter frequently disappears with the onset of the bronchitis, and reappears during convalescence. This is, indeed, consistent with the theory that asthma is the congestion stage of bronchitis before secretion has become established. On the other hand, it is notorious that the climate which suits one affection is often bad for the other. Asthmatic patients may be relieved by residence in London, by a journey on the Underground Railway, or by other conditions excessively bad for bronchitic patients. A patient may avoid bronchitis by wintering in a warm climate, such as the Riviera, where he may suffer severely from asthma. Again, asthma follows influenza and similar affections, which leave functional neuroses behind them more often than catarrhal affections, such as pneumonia and bronchitis. Brodie's experiments, which appear to confirm this view, will be immediately described.

The theory that asthma is due to a transient oedema or vasomotor turgescence of the bronchial mucous membrane has some points in its favour. It is sufficient to explain the sudden onset of the asthmatic spasm and brings the pathology of the affection more closely into line with that of hay fever. As already shown, asthma and hay fever are often closely associated, they may occur concurrently or alternately in the same patient, and it is possible that the bronchial mucous membrane is affected by frequently repeated great swelling, similar to that of the nasal mucous membrane in hay fever. This theory accounts for the secretion which is almost always present, and for the tendency to subsequent bronchial attacks. The chief objection is that the bronchial mucous membrane is dissimilar in structure to the nasal mucosa, and does not contain the large vascular plexuses which form such a marked feature of the latter.

Accepting then, as a working hypothesis, that asthma is due either to a spasmodic contraction of the muscular fibres of the smaller bronchioles, or to a sudden vasomotor turgescence of the bronchial mucous membrane, and assuming that these disturbances can be produced by a nervous reflex, we must next consider the evidence that they originate in the nose. Five conditions were above postulated as proof that an affection was a reflex nasal neurosis (see page 247). It will be well to discuss each point and to see how far asthma fulfils the required conditions.

Association of Asthma with Nasal Disease. Clinical experience shows that asthma is by no means constantly associated with definite disease in the nose. Bosworth's assertion that it almost invariably depended upon nasal obstruction was quickly refuted by numerous observers, who variously estimated that nasal obstruction was present in not more than 10 to 50 per cent. of their cases. Lubinski in 500 cases of asthma found various nasal affections present in 143: 40 of these were relieved or cured by removal of the nasal trouble. Francis in 402 cases found disease of the nose in 56: he considered these the most unfavourable cases with regard to prognosis. It is true that in some cases asthma is associated with adenoids, with nasal polypi, with large or small deviations or thickenings of the nasal septum, or with hypertrophic rhinitis, and the beneficial effects of treatment often seem to indicate that the asthma directly depends upon these diseases. Thus the removal of adenoids may cure asthma of long standing, and the recurrence of the adenoids may provoke a recurrence of the asthma, which will again cease directly the growths are removed. The same sequence of events is even more frequently observed in nasal polypus. Still the removal of nasal polypi by no means invariably cures asthma—it may indeed make it worse (MacDonald). Richardson has recorded similar results from treating antrum suppuration, the asthma in two cases being relieved immediately the sinus was drained and returning directly the pus was allowed to re-accumulate. But in the great majority of asthma cases the only irregularity in the nose is some trifling spur or thickening of the nasal septum such as can hardly be looked upon as an abnormality at all. Most present day observers, even the enthusiasts for nasal treatment, agree that the nose is most often free from all signs of disease.

The Presence of a Nasal Aura. Attacks of sneezing or of paroxysmal rhinorrhoea may precede an attack of asthma. A patient may wake up suddenly at night with itching in the nose or severe smarting pain followed by sneezing and profuse watery discharge; the asthmatic seizure shortly follows. True hay fever is occasionally followed by asthma. Again, attacks of paroxysmal sneezing may alternate with asthma, or the patient may have suffered from them for years before the onset of the asthma. In my experience these cases are the most amenable to nasal treatment, a fact also noted by Francis. Occasionally other premonitory nasal symptoms are present, but in most cases of asthma the patient is unconscious of anything wrong in the nose.

Experimental Production by Irritating the Nose. The asthmatic seizure can never be excited by irritating the nasal mucous membrane in the living subject even in those predisposed to it. It is true that sometimes the nasal mucosa may appear unduly sensitive in places: this is perhaps a symptom of the general nervous condition of the patient. Sometimes a "cough reflex" may be excited by touching the mucous membrane on the anterior part of the inferior turbinate or of the septum in place of the more common sneezing reflex. Irritation of the posterior parts of the nose normally produces cough. It is doubtful if the importance which has been attributed to this phenomenon is justified. It has not yet been shown that a cough reflex is more commonly produced in asthmatic than in normal patients, and even if it were so asthma and cough are by no means identical. The important experiments of Dixon and Brodie must be briefly alluded to, as they tend to show definitely that asthma, or at any rate a condition of bronchial spasm closely resembling asthma, can be produced in the lower animals by stimulating the nasal mucous membrane. They first showed that stimulation of the peripheral end of the vagus produced constriction of the bronchial muscles to such an extent that it diminished the air entry into the lungs to a fourth of its natural volume. Further, this spasm could be excited reflexly by electrical irritation of the mucous membrane covering the upper and posterior part of the nasal septum. The path of the reflex was the vagus: when the nerve was divided the contraction of the muscles immediately relaxed, and if the nerve had been previously divided no reflex contraction could be excited. These observers were unable to excite bronchial spasm by stimulating the mucous membrane of the stomach, or the terminations of the cutaneous or any other nerves. They further showed that muscarine caused asthma in animals by producing spasm of the bronchial muscles, which was immediately relieved by atropine. Ligature of the pulmonary vein caused congestion of the pulmonary vessels but did not interfere with the entrance of air into the lungs. They concluded that the asthmatic attack was due to a bronchial spasm which was probably of reflex origin. These experiments are very suggestive, but even if they showed that asthma in the human being was due to spasm of the bronchial muscles they fail to prove that this spasm is invariably excited by irritation applied to the nasal mucous membrane. All clinical experience is opposed to such a view. They do indicate the close connection existing between asthma and the nose, a relationship already established by clinical experience.

Effect of Anaesthetizing the Nose. The observation which most definitely indicates that asthma is a nasal reflex, is that the application of cocaine to the nasal mucous membrane will often immediately relieve an asthmatic spasm. This drug forms the active ingredient of many successful patent "cures." Cocaine does not, however, according to my experience relieve all the asthmatic symptoms, nor does it act on every patient

so well as Himrod's powder, or the inhalation of other antispasmodic, such as hyponitrous acid. At the same time it is interesting to note that adrenalin or suprarenal extract does not produce anything like so marked an effect on the asthma, although it produces greater effects than cocaine in contracting the nasal mucous membrane and in overcoming nasal obstruction.

Effects of Nasal Treatment. The evidence derived from the results of treatment directed to the nose is open to much discussion. Whilst it is undoubtedly true that asthma may frequently be cured or relieved by intra-nasal treatment alone, it is by no means clear in what way the treatment acts (see p. 247). Further, many a so-called cure is really only temporary relief. It must be remembered that asthma is essentially a neurosis, and that many trivial procedures may exert a great effect. Thus examining the nose with Killian's speculum, inserting the finger into the post-nasal space, and similar proceedings have occasionally effected cures. Such slight alterations as the change from one house to another in the same street, or even from one room in a house to another, often has a most marked effect upon the occurrence of asthma.

In the present state of our knowledge one would certainly not be justified in asserting that nasal treatment removed the cause of the affection. Francis indeed asserts that asthma is not a nasal reflex, but is the result of instability of the respiratory centre and that the beneficial results of nasal treatment can only be explained on the hypothesis that it restores the stability of this centre. The precise significance of this assertion is not clear. At present all that can be stated is, that asthma is in some way closely connected with the nose although it depends upon no definite nasal affection, that it can often be cured or relieved by nasal treatment, and that therefore intra-nasal treatment is not only justified but indicated.

Treatment. The nasal treatment of asthma must be considered in connection with the varying conditions found in the nose.

Where Definite Disease is Present. In these circumstances there is little diversity of opinion: most surgeons would advise the removal of any gross lesion quite apart from the asthma. The results vary in the most astonishing manner. Many instances are on record in which the removal of adenoids has been followed by cessation of the asthma: five or six have occurred in my own practice. Occasionally it has been noted that the asthma has returned when the adenoids have recurred or nasal obstruction due to some other cause has developed. Thus, in two of my cases recurrence of asthma was found to be due to subsequent hypertrophy of the inferior turbinates and passed off again immediately this was rectified. In the majority of the cases, however, removal of adenoids has no effect on the asthma, or its beneficial results are very fleeting.

Similar statements hold good with regard to the effect of the removal of nasal polypus. Many cases are recorded in which the clearing of the

nose has arrested the asthma for a time: and the asthma has returned, as the polypi have recurred. Several striking instances of this close association between the two diseases have been under my own care. Latterly in these cases I have advised the radical operation above described for nasal polypus (see Chap. XI.). I believe that when this operation has been performed, and not only the polypi, but all the diseased bone and mucous membrane in the ethmoidal region, have been removed, better results are obtained, more cures of asthma and more permanent results. Walker Downie has also advocated thorough removal in these cases. Still in many cases removal of polypi does no good, and in a few actually seems to exert an adverse effect, the asthma becoming more severe (Macdonald). Francis even states that he has obtained better results by cauterizing the septum and leaving the polypi alone. This proceeding, advocated through fear that removal of polypi will make the asthma worse, will hardly commend itself. Perhaps partial removal of the disease, as by the snare operation, may occasionally do harm. I have never seen the asthma made worse by a thorough and complete clearance of the nose.

Hypertrophy of the inferior turbinate, anterior or posterior, should certainly be treated in a radical manner. Removal with scissors or with a snare, or in simple cases reduction with the cautery, should be practised. Greville MacDonald states that, in his opinion, these cases have yielded the most favourable results of all; an opinion I am inclined to share. In enlargement of the middle turbinate, by an oedematous or polypoid condition of the mucous membrane or bony cyst of the anterior end, I should strongly advocate the removal of the whole of the structure with a spoke-shave. It has often been pointed out that the most successful cases are those associated with a few small polypi, and in my own hands permanent freedom from asthma has often followed the thorough extirpation of disease in this region.

Deflections and thickenings of the septum should also be treated if they are producing nasal obstruction. The result on the asthma is very doubtful. Sometimes relief, permanent or temporary, is obtained; in other cases there is no benefit. For this reason I should certainly not advocate the removal of small spurs or ridges which were producing no nasal symptoms. Waggett has recorded an interesting case of asthma of ten years' standing which was arrested by removing a spur from the septum and twice returned when adhesions formed at the site of the operations.

Any other disease of the nose which may be present, such as rhinitis sicca, ozaena, etc., should be treated energetically. This sometimes yields good results, as in one case recorded by MacDonald, and several instances have occurred in my own practice.

When a Nasal Aura precedes the Asthmatic Attack. This class yields the most favourable results of all. The prodromal symptoms may take the form of itching in the nose or of sudden nasal obstruction, but most commonly consist of severe sneezing attacks with profuse rhinorrhoea.

The paroxysms of rhinorrhœa may immediately precede the asthmatic attacks, or alternate with them, or may have preceded them for some months or years and have passed off when the asthma commenced. In these cases the nose should be thoroughly treated as for hay fever in the way above described. Gross nasal lesions should be removed: failing these, the inferior turbinates should be cauterized. If milder measures fail the inferior turbinates and even the middle turbinates should be excised.

Where no Nasal Symptoms are Present. This is by far the largest and the most difficult group of cases to deal with. The first question that arises is whether any signs can be elicited which would indicate the probable success of intra-nasal treatment. The so-called "cough spots" have already been mentioned. When a probe is passed carefully over the nasal mucous membrane, it may appear as if there were hypersensitive spots, contact with which may produce a cough. Many observers recommend that all such spots should be carefully sought for and destroyed with the cautery under cocaine. The procedure is quite unreliable. It is very difficult to judge of the sensitiveness of the nasal mucous membrane; or to be sure that it is more sensitive in various areas. Neurasthenic patients are often hypersensitive. Irritation of the mucous membrane in the posterior and upper parts of the nose normally produces a cough reflex and, as already said, asthma itself cannot be produced by stimuli applied to the nose. Thus this test cannot be used as a guide to the site of origin of the asthmatic stimulus, nor does it afford any sort of hope that the case will prove a successful one.

Secondly, it is a commonly observed clinical fact, that the actual asthmatic spasm may often be arrested by applying cocaine to the nasal mucous membrane. The effect is often instantaneous, but it apparently matters little to which part of the nose the cocaine is applied, and it by no means follows that the application of the cautery to the same region will arrest the asthmatic spasm or prevent its recurrence. In my hands the results of treatment following this clue have not given satisfactory results.

It must be admitted that we have as yet no means of foreseeing the effect of nasal treatment upon asthma, and must rely on careful experiment in each individual case. Is it then right to try what can be done with intra-nasal treatment? Francis recommends the application of the cautery to the septum in every case; MacDonald and others have been apparently converted to this view. Other rhinologists, following Hack's original directions, cauterize the inferior turbinate. Others have recommended the application of the cautery to the tubercle of the septum, and Moritz Schmidt advises the removal of this structure. These methods are purely empirical; no rational explanation of their action has been produced.

Francis describes his method as follows: Under cocaine anaesthesia he draws a line with a galvanic cautery point from a spot opposite the

middle turbinated body, forwards and slightly downwards, for a distance of rather less than half an inch. In about a week's time he repeats the operation on the other side of the nose, and afterwards cauterizes alternate sides at intervals of ten days or a fortnight as occasion requires. On each occasion he selects a fresh place. He considers the exact situation of the spot from which the effect will be obtained is not the same for all patients, but in the majority of cases it is situated on that part of the septal mucous membrane which lies opposite and immediately above the anterior end of the middle turbinate. Sometimes he cauterizes the posterior extremity of the septum. He considers harm is often done by too extensive destruction. Francis claims that all cases are equally curable, however long the asthma has been present, or in however severe a form. His best results were obtained in severe asthma with no disease in the nose. The most unfavourable cases were those associated with nasal polypus. In a series of over 600 cases he claims to have obtained 60 per cent. of permanent and absolute cure, 27 per cent. of great improvement, and no relief in only 5 per cent.

MacDonald¹ stated that in the preceding two years he had had over 40 per cent. of cures in 95 cases, but obviously in none of these had the results been observed sufficiently long to justify the term "cure." Permewan² stated that asthma could unmistakably be greatly relieved by treating the nose, and that recurrence of the asthma indicated the necessity for further nasal treatment. Personally I have had the best results from cauterizing the inferior turbinate: the results of applying the cautery to the upper and posterior part of the septum as Francis recommends have not been so favourable.

In the present condition of uncertainty I think the patient should have the facts, so far as they are known, explained to him, and that he may be advised to undergo nasal treatment provided its experimental nature is recognised. In the first place, the anterior ends of the inferior turbinates should be cocaineized and linear cauterization performed, one or two lines on each side; after an interval of a week or more the posterior ends may be similarly treated. If this fails the tubercle of the septum or the part of the septum opposite the anterior end of the middle turbinate should be treated in a similar way. And, lastly, I should be inclined to cauterize the posterior and upper part of the septum. Francis considers that ill-success following the application of the cautery is often due to excessive cauterization: one or two short lines are quite sufficient at each sitting. I have had patients state to me exactly as Francis has said, that when the upper part of the septum had been cauterized they felt as if something had been cut, which had loosened the knot in their chest; yet in spite of this the treatment has been a failure. If after careful trial

¹ *Brit. Med. Journ.*, 1904, ii. 1231.

² *Proc. Laryngol. Soc. of London*, 1899, vi. p. 95.

these measures fail nasal treatment must be abandoned. If the milder measures do not succeed even temporarily, stronger measures are almost certain to fail, and will leave behind considerable destruction of the nasal mucous membrane, with impairment of the nasal functions, to the lasting discomfort of the patient. The little I have recommended can do no harm even if it fail to benefit.

Climatic Treatment. Few words need be said here about other methods of treatment, although they are very important. As is well known, many patients suffer from asthma only in certain districts or even in certain houses. If a patient is at liberty to choose his residence and can find a place in which he is free from asthma no further treatment seems necessary. If, as is often the case, a patient suffers from asthma in one house, whereas in another house at a short distance he remains quite free, the change leads to little inconvenience. Often it is necessary to send the patient far afield, as to a seaside or mountain resort, or to the Riviera, which may be exceedingly inconvenient, or impossible. When a patient can afford it climatic treatment may reasonably be combined with other measures. It is often well to send a patient away for three or four months or longer after nasal treatment to complete his cure, and, as it were, to break the asthma habit. The particular place that will suit a particular patient can only be determined by experience; if the first place chosen does not agree he must move on to another. Further, climatic treatment may be profitably combined with a hydropathic or other cure. This is especially useful in the neurasthenic patient.

Diet often exerts a marked determining influence on asthma. An indigestible supper may excite an attack, whilst careful dieting will often diminish their frequency. This question should therefore be inquired into, and careful dieting may be prescribed in conjunction with other measures.

General Measures. The majority of asthmatic patients suffer in some degree from neurasthenia or other form of neurosis. Tonics such as iron and strychnine almost always do good and are often a valuable preliminary to successful nasal treatment. Besides this, two drugs, arsenic and potassium iodide, have been recommended almost as specifics in asthma. Arsenic has the advantage of being a tonic as well as an anti-periodic: it may be prescribed together with iron and strychnine and continued so long as it can be well borne. Potassium iodide is usually given in small doses, 3 to 5 grains, and certainly appears sometimes to exercise a good effect.

Further information as to the dietetic, climatic and medicinal treatment of asthma must be sought for in works on general medicine.

Conclusion. The study of asthma presents exceptional difficulties and its treatment is surrounded with doubt and uncertainty. Quite apart from any theory as to the causation of asthma I am inclined to recommend treatment on the following lines:

1. When dietetic or climatic treatment suffices to prevent the asthmatic attacks and can be conveniently carried out other treatment is unnecessary.

2. That otherwise nasal treatment should be adopted in the following circumstances :

- (a) When there is definite disease in the nose.
- (b) When there is a nasal aura preceding the asthmatic attack.
- (c) When the nose is healthy, provided the patient is in otherwise good health, and understands the experimental nature of the treatment.

3. The above methods should be combined with medicinal, especially tonic, dietetic and climatic treatment.

The following may be consulted :

GREVILLE MACDONALD, SAMUEL WEST, and others. *Brit. Med. Journ.*, 1904, ii. p. 1231.

WALKER DOWNIE. *Glasgow Med. Journ.*, 1900, liv. p. 249.

RICHARDSON. *Laryngoscope*, 1899, vii. p. 87.

SWAIN and discussion in *Amer. Laryng. Assoc.*, May, 1899 ; reported in *Journ. of Laryngol.*, 1899, xiv. p. 489, etc.

POSTHUMOUS MEYJES. *Journ. of Laryngol.*, 1898, xiii. p. 580.

PERCY KIDD, M'BRIDE and others. *Proc. Laryngol. Soc. of London*, 1899, vi. p. 83, and *Journ. of Laryng.*, 1899, xiv. p. 336.

BRODIE AND DIXON. *Transactions Path. Society of London*, 1903, liv. p. 17.

ALEXANDER FRANCIS. *Asthma in relation to the nose*, London, 1903.

CHAPTER XV.

SUPPURATION IN THE ACCESSORY CAVITIES OF THE NOSE.

AETIOLOGY AND PATHOLOGY.

Introduction. The affections of the accessory sinuses and air cells of the nose form a modern chapter in rhinology. Their frequency and importance had been overlooked up till quite recent years, owing, mainly, to the absence of any striking symptom and to the deep-seated, inaccessible position of the cavities. Occasional references to suppuration in the frontal sinus and maxillary antrum are found scattered in older medical literature, attention having been drawn to affections of these sinuses by disease of their external walls, and to the antrum also in connection with diseases of the teeth. Rheiningcr in Germany in the seventeenth century, Desault in France, and Hunter in England in the eighteenth century, described cases of acute antral suppuration. Spencer Watson in England, and Schech in Germany, were among the first to direct proper attention to these diseases, but our present knowledge is largely derived from the work of Ziem, who himself suffered from antral suppuration. Morell Mackenzie, in his work on the diseases of the nose published in 1882, does not even mention sinus suppurations, and Hyrtl in the same year asserted that the sphenoidal sinus was quite outside the field of surgical interference. Schäffer in 1885 was apparently the first to operate upon the sphenoidal sinus in the living body. It is possible that the increased frequency of sinus affections since 1889, owing to the prevalence of influenza epidemics, has afforded more opportunities for study and has been the cause of the great attention devoted to the subject.

The following works will be frequently alluded to:

- LOGAN TURNER. *The Accessory Sinuses of the Nose.* Edinburgh, 1901.
GRÜNWALD. *Die Lehre von den Naseneiterungen.* München, 1898, 2nd edit.
(There is an English translation by Lamb.)
HAJEK. *Path. u. Therap. der entzündl. Erkrankungen der Nebenhöhlen der Nase.* Leipzig u. Wien, 1899.
ZUCKERKANDL. *Anat. und Path. der Nase und seiner pneumatischen Anhänge.* Wien, 1880.

- WESTMACOTT. *Medical Chronicle*, 1902, 4th ser., iii. p. 145.
- KUHNT. Ueber die entzündlichen Erkrankungen der Stirnhöhlen und ihrer Folgezustände, 1895.
- LUC. Leçons sur les suppurations de l'Oreille moyenne et des cavités accessoires des fosses nasales. Paris, 1900.
- LERMOYEZ. Traitement des maladies des fosses nasales. Paris, 1896.
- DREYFUSS. Die Krankheiten des Gehirns und seiner Adnexa in Gefolge von Naseneiterungen, 1896.
- Articles by KILLIAN and SCHAEFFER in Heymann's *Handbuch der Laryngol. u. Rhinol.*, Band iii. Wien, 1899.
- FRIEDRICH. *Rhinologie, Laryngologie und Otologie in ihrer Bedeutung für die allgemeine Medicin*, 1899.

AETIOLOGY.

The earlier observers, who were chiefly concerned with suppuration in the antrum, considered that the commonest, if not the universal cause, was disease of the teeth. As soon, however, as the occurrence of chronic suppuration in other of the accessory cavities came to be recognised, it was seen that other causes must be at work, and since then it has been found that a large variety of conditions may excite catarrh and suppuration of the accessory cavities. Some of these causes must be considered in detail.

Acute Infective Diseases. Acute catarrh of one or more of the accessory cavities of the nose is a frequent accompaniment and consequence of the severe specific infections, such as influenza, measles, scarlet fever, whooping-cough, pneumonia, typhoid fever, smallpox, erysipelas, cerebro-spinal meningitis, etc. The evidence in favour of this is clinical, pathological and bacteriological.

1. The **clinical evidence** is especially strong with regard to influenza, which, most observers are agreed, is a fruitful cause of the affection. Hajek, Killian, Grünwald, Watson Williams, Mackie, Röpke, Weichselbaum, Vansart, etc., state that the majority of their cases have been due to influenza; this has been my own experience. The increased frequency of sinus affections in recent years is probably due to the prevalence of influenza as much as to increased zeal and improved methods in diagnosis. In twenty-nine cases of suppuration in the maxillary antrum Siebenmann found that five followed influenza; two others followed bronchitis and pneumonia, and another case was probably due to influenza. Jeafferson saw two cases after scarlet fever and Troughand¹ one: Flatau one after measles and two after erysipelas. Grünwald saw one case following pneumonia, one following typhoid, one probably due to scarlet fever and one to diphtheria. Of 12 frontal sinus cases Röpke ascribes three to influenza and one each to typhoid fever and pneumonia. Schäffer ascribes five cases out of forty-three to erysipelas: numerous other

¹ *Journ. of Laryngol.*, 1902, xvii. 383.

observers have seen a similar association, but the exact relationship of these two affections to each other is doubtful (see page 270).

2. The **pathological evidence** is even more conclusive. Thus Harke in thirty post-mortem examinations of children dying of diphtheria, whooping-cough, scarlet fever, measles and chickenpox, in every case found suppuration in one or more of the nasal accessory cavities, most frequently in the maxillary antrum. In thirty-seven cases of typhoid fever, pneumonia, influenza, erysipelas, and meningitis in adults, he found suppuration in some of the sinuses in thirty-one. Weichselbaum found pus in the accessory cavities—most often in the frontal sinus and maxillary antrum—in all of sixteen cases of influenza. Similar evidence is provided by the reports of others, among whom may be mentioned Lichtwitz, Fränkel and Siebenmann. More recently Kirkland of Sydney has reported the results of an investigation into the condition of the sinuses in one hundred consecutive post-mortem examinations. In twenty-two cases of pneumonia, many of which were probably complicated by influenza, suppuration was found in one or more sinuses in eleven, that is, in 50 per cent. Of the whole series, sinus suppuration was found in 35 per cent. and other similar statistics can be quoted. Thus Harke found sinus suppuration present in 134 out of 400 post-mortem examinations, that is in 33.5 per cent.; Minder in 14 out of 50 examinations, that is in 28 per cent.; Lapalle in 55 out of 169, that is in 32.5 per cent.; Fränkel in 63 out of 146, that is in over 40 per cent.; and Gradenigo in 26 out of 100.

These figures raise a point of some importance which merits brief discussion. The frequency of sinus affections as shown by post-mortem examinations is greatly in excess of that found by clinical experience. Thus Chiari and Lichtwitz found sinus suppuration in 2 per cent. of the patients attending their clinics, which is probably a fairly average proportion. The great difference between these numbers is usually explained by stating that acute sinus suppuration is often overlooked during the progress of another disease, and that chronic suppuration may give rise to no marked symptoms beyond nasal catarrh, or at any rate may remain unrecognised during life.

This explanation, although accepted without question by many well-known rhinologists, *e.g.* Lichtwitz, appears to me quite insufficient. I should prefer to account for the great difference which exists between pathological and clinical experiences by the following considerations:

(a) The observations were all on cases of fatal disease; that is, of severe infection associated with grave constitutional disturbances. It is therefore only to be expected that serious complications would be more frequent than in the non-fatal, or milder, cases of the same affection.

(b) The pus or muco-purulent secretion found in the cavities may have been present only shortly before death. The action of the ciliated epithelium lining the accessory sinuses must be taken into account. Ciliary movement is a force of very great importance. A large sinus

such as the antrum, the lining membrane of which contains glands, must normally secrete a considerable amount of fluid, and this will be greatly increased in catarrh. The secretion is removed through the small opening at the top of the cavity, and its removal therefore depends entirely upon the ciliary movements. While the cilia are active all secretion is removed, but just before death, perhaps some hours before, the action of the ciliated epithelium becomes enfeebled or possibly ceases, and thus it is to be expected that the cavities would in many cases contain secretion after death, especially if there has been any catarrh. The presence of fluid may mean only a little catarrh which would have entirely passed off if the patient had recovered, or it may mean loss of ciliary action only. It is not proved therefore that a little discharge found in a sinus post-mortem is conclusive evidence of sinus suppuration. Definite pathological changes in the sinus walls are the only true criterion. If this caution were adopted in future, more reliable statistics would be obtained and the frequency of sinus suppurations, as based upon post-mortem reports, would probably be greatly reduced. The presence of simple serous or mucoid fluid is without any significance. The above explanation has been accepted by Semon, who states that he had never doubted that the frequency with which pus had been found by reliable observers in these cavities post-mortem was only explicable by the assumption that the matter had found its way in after death, or more probably during the agony.

(c) Many acute sinus inflammations recover spontaneously; this is a well-known clinical experience, numerous instances of which are on record. During the height of the primary affection a collection of matter in one of the accessory cavities is very likely to be overlooked, and when the patient becomes convalescent the sinus affection passes off.

These considerations indicate that evidence derived from post-mortem examination alone must not be accepted as absolute, although it is very valuable when confirmed by clinical observations. Some of the conditions which, upon this evidence alone, are given as causes of sinus suppuration must be regarded with doubt. Thus, E. Fränkel found suppuration in the accessory cavities in five out of eleven post-mortems on patients dying of peritonitis, in two of which the bacillus coli was found in the pus. Glanders, parotitis and other diseases have been mentioned as possible causes on post-mortem evidence alone.

3. A certain amount of **bacteriological evidence** has also been produced. Lindenthal showed that the bacillus of influenza was present in the pus of a sinus affection due to influenza. E. Fränkel and Howard confirm this result in two other cases. The diphtheria bacillus has been found by Weichselbaum, Fränkel and Dmochowsky, but it is not invariably present in the cases due to diphtheria, as shown by Zuckerkandl. Killian states it is present in fifty per cent. of the cases. The diplococcus of

pneumonia has been found in disease of the accessory sinuses following pneumonia (Fränkel and Weichselbaum). This diplococcus is frequently found in the sinuses even under normal conditions; and it is not unlikely to be one of the common causes of suppuration. Friedlander's pneumonia bacillus has also been found. The most common organisms found in the pus are the streptococcus, the staphylococcus albus and aureus, the diplococcus lanceolatus, the bacillus pyocyaneus and bacillus coli. In twenty-two cases out of forty Hoffmann's pseudo-diphtheria bacillus was found and Weichselbaum's meningococcus is also frequently present. Stacy, of Sydney, examined bacteriologically twelve cases post-mortem: in eight the staphylococcus pyogenes was found, in four the streptococcus, and in six a diplococcus resembling the pneumococcus. In ten cases examined by Herzfeld and Hermann the staphylococcus was found in seven and the streptococcus in eight. In twenty-one cases examined by Dmochowsky the streptococcus and staphylococcus were found in three each, the pneumococcus in two and bacillus pyocyaneus foetidus in ten. These organisms are frequently associated with each other and with various saprophytic bacteria such as sarcinae, which render the work of differentiation very difficult.

Thus bacteriological observations confirm the clinical and pathological evidence already adduced, that catarrh of the accessory cavities may be due to the acute infectious diseases, and suggest that sometimes the sinus affection may be a primary consequence, and due to the specific micro-organism, but that more often it is the result of a mixed infection, for pyogenic organisms are also present. There is no definite evidence at present to show that a particular organism or mixture of organisms is associated with a definite sort or degree of inflammation.

Cases showing a close relationship between **erysipelas and sinus suppuration** have been reported by numerous observers, amongst whom may be mentioned Zuckerkandl, Killian, Ziem, Grünwald, Hajek, Schäffer, and Luc. An organism similar to, if not identical with, the streptococcus of erysipelas has been found in the pus from the nose. It is doubtful whether the sinus suppuration is the result of the erysipelas, or *vice versa*. Thus Hajek reports two cases, and Luc one, in which the cure of an antral suppuration apparently prevented an annual attack of erysipelas; whilst Grünwald thinks that the erysipelas may be primary. I have twice seen erysipelas follow sinus suppuration, once as a result of perforation of an antrum through the canine fossa. In both my cases the erysipelas was undoubtedly the consequence of the sinus suppuration, the pus of which contained a streptococcus. This is the probable sequence of events in most cases, although it is possible that erysipelas affecting the nose may occasionally originate the sinus suppuration.

The relationship between **pneumonia and sinus suppuration** due to the pneumococcus may be explained in a similar way, namely, that a rhinitis accompanied by catarrh of an accessory sinus is the primary affection,

and that the pneumococcus has spread downwards from this and infected the lung. Lennox Browne adopts this view, and states that it is an example of a head cold descending to the chest, and adds that the nasal discharge is the first to disappear, and the laryngeal, tracheal, bronchial and pulmonary symptoms follow in the order named. It is certain that diseases of the lungs may owe their origin to direct extension of disease from the upper air passages to the trachea and bronchi. Chronic bronchitis and bronchiectasis may be thus caused, as will be shown later. When, however, pneumonia and sinus suppuration are associated, the probability is that the pneumonia is primary and the sinus affection is the secondary result.

Mode of Infection. Another question which arises in this connection is whether the sinus suppuration should be looked upon as a direct consequence of the causative disease, or whether a rhinitis is always present and the sinus suppuration is the result of the spread of inflammation from the nose into the sinus. On this point opinions are divided. Killian believes that the majority of sinus affections are immediate consequences, a view shared by E. Fränkel: whilst Hajek believes most cases are due to the spread of catarrh from the nose. This is my own opinion, for more or less rhinitis is generally present, although it may be slight and fleeting; thus when the case is seen all signs of the rhinitis may have passed off, whilst its effects, the sinus suppuration, are more permanent. That direct spread is possible is shown by the fact that sinus suppuration has occasionally resulted from an acute infection following an operation on the nose (see page 273). It is possible that infection may take place by the nasal secretion being actually blown from the nose into the sinuses, as the result of sneezing or of violently blowing the nose. The possibility of this is shown by the fact that even vomited matters have been found in the sinuses (Harke and Hajek).

Simple Acute Rhinitis. A large number of the sinus suppurations that come under observation are doubtless due to ordinary colds in the head. Killian believes this to be the most common cause of all. Clinical experience suggests that catarrh of the accessory sinuses is not very uncommon in colds; but a further factor is necessary to produce suppuration. This factor may consist in impaired general health, or more often in some local cause such as nasal polypi, deflected septum, enlargement of the middle turbinate, or other lesion causing obstruction of the outlet of the cavity. It is obvious that any pre-existing nasal obstruction will be intensified by catarrh, and the resulting swelling may be sufficient partially or entirely to occlude the orifice of the cavity and thus to cause retention of the secretion. It is not necessary that the obstruction should be complete, or that all the secretion should be retained; it is sufficient that the sinus should not empty itself completely. It is possible that a very severe catarrh may of itself produce sufficient obstruction, but this is rare.

Killian considers most sinus suppurations, even those arising from

colds, as primary infections and not due to direct spread from the nose, a view which will not commend itself to many rhinologists.

The **influence of pre-existing nasal obstruction** is well shown by cases like the following, both of which were seen in a single week. A healthy girl, aged about twenty-five, consulted me for attacks of severe headache occurring with every slight cold. Two or three attacks might occur during the summer months, but they were more frequent in the winter. The headache was entirely left-sided, and most severe in the frontal region; it gradually increased in severity for two or three days, when it was relieved by a sudden gush of purulent discharge from the nose. Occasionally this cycle of events was repeated two or three times before the attack entirely ceased. In the intervals between the attacks the patient was perfectly well. On examination it was found that the septum was deflected to the left side, and that the left middle turbinate was enlarged. The aetiology was therefore clear. Every time the patient contracted a cold there was more or less catarrh in one of the accessory sinuses on the left side—most probably in the maxillary antrum—the deflected septum and the enlarged middle turbinate, aided by the inflammatory swelling due to the catarrh, produced obstruction to the outlet of the cavity, and thus gave rise to retention of the secretion and acute suppuration.

The other case was similar. A man stated that he had ten days previously contracted a severe cold in the head, associated with supra-orbital headache. The pain was followed by profuse discharge from both nostrils, after which the pain on the right side had entirely disappeared, while that on the left remained. When first seen there was evidence of general rhinitis with purulent discharge from both nostrils. The left middle turbinate was enlarged. The diagnosis made was: acute catarrh of the antrum on both sides, with partial retention of secretion on the left side due to the enlargement of the middle turbinate. The left antrum was punctured from the inferior meatus of the nose and washed out, much foetid pus being obtained. Four days later the patient had completely recovered, the right side having healed spontaneously. Hajek relates a case in which acute headache and discharge from the nose on both sides followed influenza. One side healed spontaneously; on the other the middle turbinate was enlarged, and a cure did not take place until the enlarged anterior end of this body had been removed.

Should the secretion be unduly thick or tenacious, a similar result occurs. Thus Hajek reports a case of double suppuration in the antrum, in which much inspissated thick pus was present. On one side a large accessory ostium was present, and here spontaneous healing occurred. On the other side the cure was effected by washing out the antrum on a single occasion, much pus being forced out. The probable reason for the suppuration persisting on this side was that the discharge was too thick to escape through the small natural opening.

Repeated catarrhs of a sinus may also lead to suppuration, either by

producing chronic thickening of the mucous membrane, especially round the ostium, and so slowly narrowing it, or by damaging the ciliated epithelium lining the sinus, which does not completely recover in the intervals between the attacks. In ascribing a case of sinus suppuration to repeated colds, it is necessary to be certain that the attacks are repeated after intervals of complete freedom, and that the case is not one of chronic sinus suppuration, with frequent acute exacerbations, such as is often seen. The patients' statements on this point are unreliable.

The following case is an example of antral suppuration resulting from repeated attacks of acute catarrh. A healthy man had acute suppuration in the right antrum as the result of prolonged exposure to very severe cold and wet. Alveolar puncture was performed, the pus evacuated, and a cure obtained in a week. The opening was allowed to close, the patient remained quite well for a month. Then he caught a slight cold, and the antral suppuration returned. The alveolar puncture was repeated, and again the patient was cured. On this occasion he remained well for three months and a half, when, taking another severe cold, the antral suppuration returned. He now remains quite free from discharge for the greater part of the year, but refuses to leave out the plug in the alveolar opening, and occasionally when he suffers from a severe cold there is a return of the pus in the antrum. In another case three successive attacks of antral suppuration were rapidly cured by the method of alveolar puncture. On the next occasion a counter opening was made into the nose, and since that time there has been no recurrence. Difficulty in syringing through the antrum suggested that the natural ostium was contracted.

Septic Infection after Operations. Acute inflammation of the nose arising from other conditions may also give rise to suppuration in the accessory cavities. Among these may be mentioned galvano-cautery operations, the removal of pieces of the middle turbinate and removal of nasal polypi. Such operations are occasionally followed by septic infection and acute inflammation of the nose, which may spread into one of the accessory cavities. This complication is especially likely to occur if the nose be packed for arrest of haemorrhage. Such a history was given in two of my cases. This observation establishes beyond doubt the possibility of direct spread of the inflammation from the nose to the sinuses by continuity of mucous membrane.

Again, in **atrophic rhinitis** there is a foetid, decomposing discharge in the nose, and sometimes one or more of the accessory cavities are found to contain pus. Abel states that he has found his bacillus mucosus in the pus from these sinuses. Reasons have already been given for regarding the sinus suppuration as secondary to the nasal trouble, and not *vice versa*. (See page 160.) It is probable either that the discharge is dammed back by the large crusts which are a feature of ozaena and so forced into the sinuses, or that the inflammatory changes of the nasal mucous membrane spread by direct continuity into the cavities. It is possible that in some

instances the two affections may result from the same primary cause. This latter must be very unusual, because atrophic rhinitis, as already shown, generally begins in early life and before the accessory sinuses are developed. Of the various cavities the sphenoidal sinus and the maxillary antrum are the most liable to be affected in this disease.

Another cause of acute suppuration in the accessory cavities, but a rare one, is the entrance or **presence of a foreign body**. Reports of such cases are found scattered throughout medical literature. The foreign bodies may be of the most varied kind and have been found in all the different cavities. For example, bullets or pieces of sharp instruments may enter through the thin external walls and lodge in the antrum, frontal sinus, or ethmoidal cells. Blades of grass or straw may be inhaled into the nose and work their way into a sinus through its natural opening. Occasionally live maggots or larvae have been found, most often in the frontal sinus, and vomited matters have also been met with (Harke).

Sinus suppuration may also be caused by **trauma**. Thus many of the earlier recorded cases of suppuration of the frontal sinus were the results of kicks from a horse, stabs, or blows: the antrum has been opened and infected by stabs and more commonly still by clumsy attempts at tooth extraction. Under this heading may also be mentioned any surgical operation, in which these cavities are opened, which is not, or cannot be, performed aseptically.

Tubercle, Syphilis, and Malignant Disease. The accessory cavities may be opened up by caries or necrosis of their walls as the result of disease. For example, tuberculosis or syphilis of the nose may attack and open the antrum, the sphenoidal or the ethmoidal sinuses, and allow the admission of pyogenic organisms; but even then it is rare for suppuration to result, as the extensive opening made by the disease generally establishes free drainage.¹ In a similar way sinus suppuration may be caused by malignant disease commencing in the upper jaw or in the nose. These cases are mainly of importance with regard to diagnosis, it being very important that the presence of malignant disease should be recognised and that the case should not be taken for one of simple sinus suppuration.

Carious Teeth. Finally, in the case of the antrum, infection may be of dental origin. This was formerly regarded, even by rhinologists, as the sole source of antrum suppuration, but the increased knowledge of recent years renders such a view no longer tenable. Suppuration in the other accessory sinuses cannot be ascribed to disease of the teeth, and it seems hardly reasonable to assert that causes sufficient to produce suppuration in other cavities cannot produce it in the antrum. Further, it frequently happens that all the teeth on the affected side are sound. It has been asserted that a tooth with decay on the crown but with healthy roots can be the source of trouble in the antrum,² and that infection

¹ Neufeld, *Archiv für Laryngol.*, 1905, xvii. p. 215.

² Tilley, *Journ. of Laryngol.*, 1901, xvi. p. 703.

might possibly be conveyed by the lymphatics or other channels, but to say the least this seems very doubtful. Grünwald states that in ninety-eight cases of antrum suppuration he could exclude dental causes in seventy-three, and that in eleven others this causation was doubtful, leaving only fourteen cases undoubtedly due to disease of the teeth. Suppuration limited to the antrum, especially when unilateral, is very likely to be due to disease of the teeth: when many sinuses are affected, or when the antral disease is bilateral, this origin becomes more than doubtful.

The exact path by which infection spreads from the teeth into the antrum may vary. The first and second molar teeth, more rarely the second bicuspid, the third molar, and the first bicuspid, come into close relationship with the antrum; their roots may even form small elevations on its floor and be separated from its cavity by a thin plate of bone or membrane only; even when separated by bone, small spaces may exist, allowing the transmission of vessels and nerves to the roots. Should an abscess form around the root of such a tooth, the matter may easily burst into and infect the antrum, or absorption may occur round the abscess and even a thick plate of bone may ultimately be perforated. Again, infection of the wound may occur after tooth extraction, or, if this operation be performed clumsily, the antrum may actually be opened. Occasionally a thick plate of intervening bone is found between the diseased tooth and the antral cavity, and the path of the infection is then doubtful, but it may possibly be conveyed by the lymphatics. Again, an abscess around a tooth, even one of the incisor teeth, may cause a sub-periosteal abscess over the upper jaw, and this may burst into and infect the antrum. Very rarely infection may occur from a suppurating dental cyst.

One suppurating sinus may infect another, as has been pointed out by MacDonald, Grünwald, Killian and others. Anatomical considerations would lead us to expect this to be a common occurrence. If in the cadaver, the skull being held in the normal upright position, fluid be poured into the frontal sinus, it will often be found to run directly into the antrum. Clinical evidence also points to the fact that occasionally pus from the frontal sinus or from the ethmoidal cells enters the antrum, either through its natural opening or through an artificial communication. In such conditions the antrum is said to form a reservoir for the pus coming from the other sinuses. The ethmoidal cells may be affected in a similar way by pus coming from the frontal sinus. Cases are sometimes seen in which a suppurating antrum has been apparently cured only to be re-infected by pus coming from other sinuses. In this connection, however, the action of the ciliated epithelium, which has already been alluded to (see page 268), must be borne in mind, for if the cilia are able to remove secretion from a cavity it seems to me that it would be impossible for fluid slowly oozing down to enter the antrum or ethmoidal cells in

opposition to the ciliary stream. Of course when, as the result of extensive disease, pathological communications exist between two sinuses, this argument does not hold. In my cases of frontal sinus suppuration, in all of which the antrum has been punctured for purposes of diagnosis, antrum suppuration was excluded with certainty in more than half. This mode of causation, unless pathological communications exist, is therefore doubtful and at all events rare. It is more likely that when the frontal sinus and antrum are simultaneously involved, the affection of both arose from the same cause; still, the important fact must be borne in mind that it may be impossible to cure antral suppuration until the frontal sinus has been treated. Infection from one sinus to another is more likely to occur if the outlet from a sinus, such as the infundibulum, is blocked up by swelling or polypi, or if the free escape of discharge is prevented by packing the nose after an operation. This danger most frequently arises when the nose is packed for haemorrhage following operations for polypi associated with sinus suppuration. Occasionally perhaps infection may be spread by violent attempts at blowing the nose. When the ethmoidal cells are involved primarily, secondary bone changes often occur and other sinuses may be artificially opened.

Chronic Suppuration is most commonly the sequel of acute: in only a few instances is it chronic from the beginning. The causes enumerated above generally give rise to acute catarrh or suppuration, which passes off spontaneously when the original affection subsides, or may do so as the result of simple treatment. It is comparatively rare for acute suppuration to become chronic; the conditions under which this occurs may be grouped as follows:

The outlet of the cavity may be blocked and consequently the pus does not obtain a free exit. This may arise as a result of inflammatory swelling of the mucous membrane surrounding the opening. The mucosa is loosely attached around the various ostia, oedema forms rapidly and is often very great. Further, the mucous membrane is thrown into folds, which often persist for some time after the acute inflammation has subsided, and continue to block the opening. Obstruction may also arise from polypi and other growths near the outlet of the cavity, and in rarer cases from a swollen middle turbinate or a greatly deflected septum. The obstruction need not be absolute: partial or intermittent obstruction with incomplete emptying of the cavity is sufficient to prevent recovery.

The natural openings of the cavities are small and badly placed for drainage. Thus the opening of the antrum is at the highest point of the cavity; the openings of the ethmoidal cells are frequently near the summit and are never at the lowest point: the opening of the sphenoidal sinus is high up in its anterior wall; the frontal sinus alone has a dependent exit and this usually opens into a long, tortuous canal. Thus the drainage of these cavities is very defective and the removal of the secretion almost entirely depends upon the action of the ciliated epithelium; when this is

damaged the secretion necessarily accumulates in the cavity. That the situation of the openings has a considerable influence is shown by the relative frequency of chronic suppuration in the various cavities: thus the antrum is the most often affected, the frontal sinus the least often, and when all the sinuses are involved in an acute process the latter is the first to recover (Zuckerkindl).

The severity of the original infection may so injure the tissues lining the cavity that spontaneous recovery is impossible. Changes in the epithelium may occur leading to the loss of the cilia, or much, or all of the epithelium may be replaced by cubical cells. This may be compared to the changes already described as occurring in purulent rhinitis (see page 133), which may also lead to an incurable affection of the nose. Severe infection or persistent suppuration may provoke secondary changes in the mucous membrane or bones, such as polypi, granulations, caries, or necrosis: and thus may result in chronic suppuration. The general debility of the patient may predispose to these changes.

Repeated attacks of Catarrh may permanently injure the mucous membrane, which becomes infiltrated with inflammatory products, and after each attack returns less readily to the normal condition: or may lead to gradual constriction of the opening of the sinus. This is illustrated by the following case. A patient came under my care for antrum suppuration of three months' duration, undoubtedly due to a root abscess of the first molar. Removal of the tooth and daily washing out of the antrum effected a cure and the patient remained well for three months. He then contracted a cold, which was followed by a return of the suppuration in the antrum. This was again opened and irrigated through the alveolar margin and a cure once more followed. This time the patient remained well for eighteen months, when, as the result of another cold, the antrum again became affected and although treated in the same way as before a complete cure was not obtained.

The Cause may continue in Action. For example, the cavity may contain a foreign body; or may be acting as a reservoir of pus coming from another sinus; or a carious tooth may have perforated into the antrum. In a very few cases, such as those in which a large opening into the sinus has formed as the result of tubercle, syphilis, or malignant disease, the sinus suppuration may be looked on as chronic from the beginning. Cases due to ozaena may perhaps be added to this category. Killian is alone in considering a large number of sinus suppurations chronic from the commencement. This is against all analogy, as for example of suppuration in the ear, as well as contrary to general experience in nasal suppuration.

PATHOLOGY.

In **acute catarrh** the mucous membrane lining the affected cavity becomes congested, swollen and oedematous; it is red, semi-translucent and gelatinous in appearance. The swelling is often very marked, may be diffuse or in patches, and is due to obstruction of the efferent vessels. According to Killian these consist of two systems, the chief of which pass out through the ostium, whilst the smaller ones—*vasa perforantia*—pass out through the bony walls. If all the vessels are obstructed general swelling occurs, and may be so great as to fill the cavity. If the *vasa perforantia* remain pervious localised patches of oedema only are found. The mucous membrane is infiltrated with round-celled exudation, and in places the epithelium is destroyed. Haemorrhages into the lining membrane or even into the cavity are common. The secretion in the sinus may be thin and serous, purulent, or muco-purulent, in the latter cases being generally mixed with blood. It may also contain cheesy particles. Occasionally in post-mortem examinations an acute fibrinous inflammation of a sinus has been found, with or without secretion; sometimes, but not always, this has been due to diphtheria. Acute catarrh or suppuration is often limited to a single sinus.

Chronic suppuration on the other hand, except in the case of the antrum, is generally multiple, probably because a more severe infection has been required to produce it and this at the same time has involved other cavities. Killian states that 37 per cent. of his cases were multiple. Grünwald gives the proportion at 34.5 per cent., and these numbers agree with my own experience. As regards the individual sinuses, the antrum is probably the most often affected, the ethmoid, sphenoid and frontal sinuses come next in order of frequency. The older reports give a great predominance of antral affections, probably because they were more easily recognised. Laubi stated that the antrum was affected in 75, the frontal sinus in 7, the ethmoidal in 3, and the sphenoidal sinus in 1, and Alexander's statistics are in substantial agreement. Lapalle found the antrum affected 48 times, the sphenoidal sinus 19 times, the ethmoidal cells 6 times, and the frontal sinus 5 times. Mackie found the ethmoidal cells involved 43 times, the antrum 11, the sphenoidal sinus 9, and the frontal sinus 7 times. There is no doubt that the frontal sinus is the least often affected, and that the ethmoidal cells and the sphenoidal sinus are far more often involved than was formerly recognised.

In chronic suppuration **secondary pathological changes** often occur and may be discussed under the heads of (1) Changes in the lining mucous membrane with the formation of granulations, polypi, or cysts. (2) Disease of the bony walls, periostitis, caries, and necrosis. (3) Changes in the surrounding tissues and neighbouring organs. (4) Remote and constitutional effects.

Changes in the Lining Mucous Membrane. The mucous membrane lining a chronic suppurating cavity always shows signs of inflammation. It is thickened, corrugated, and its vascularity is increased. There is a large amount of round-celled infiltration and in the older cases marked new formation of fibrous tissue. The walls of the vessels are thickened, and scattered through the mucous membrane there may be small pigmented areas, the remains of old haemorrhages. The epithelial lining usually appears as a thin layer of cells which are evidently proliferating, the cilia are often indistinct or absent and the cells cubical in shape. (Zuckerkindl, Harke, Fränkel.) In places the epithelium may be altogether absent, especially in the lower part of the cavity, and the membrane changed into granulation tissue; extensive or total absence of the epithelium is very uncommon. The granulations may later become covered with epithelium and give the membrane a papillary appearance. **Polypi** similar in all respects to those occurring in the nose may be found occasionally in all the sinuses. They are especially common when the suppuration is of old standing and, as in the nose, probably depend upon disease in the underlying bone, gross lesions of which are frequently found associated with them. Obvious bone disease was present in all the cases occurring in my own practice: also in two cases related by Scanes Spicer.¹ Heymann found polypi in the antrum fourteen times in 250 post-mortem examinations: Luschka five times in 60, and Zuckerkindl six times in 300. These numbers are probably in excess of the truth as has already been explained (see page 187).

Cysts of varying size are also not very rare. They are most often found in the antrum, and apparently arise from distension of the mucous glands. They contain mucus, muco-pus, or, more rarely, serum. Microscopical sections often show round-celled infiltration round the ducts of the glands, and this, or contraction of newly formed fibrous tissue, may obstruct the duct and cause the acinus of the gland to become distended by retained secretion. The glands throughout the mucous membrane show signs of degeneration and partial desquamation of the epithelium.

Changes in the Bone. The mucous membrane lining the accessory cavities is so intimately blended with the periosteum that inflammation of it is invariably associated with **periostitis**. The periosteum becomes greatly thickened, and active changes in its deeper layers may take place and lead to the deposit of new layers of dense bone. This new bone is frequently deposited in an irregular fashion, and gives rise to roughening of the inner wall of the affected sinus, and even to the formation of large osteophytes (see Fig. 103). In other parts of the bone caries or necrosis may at the same time be actively progressing. **Caries** of the bony walls even in long-continued suppuration is rare, and its occurrence has been denied; but in recent years these cavities have been so often opened and their interiors inspected that its existence can no longer be doubted. It is most common,

¹ *Journ. of Laryngol.*, 1899, xiv, p. 125.

perhaps, in association with suppuration in the ethmoidal cells, but is also found in the other sinuses. Grünwald states that he has found caries thirty-one times in 55 cases of suppuration in the ethmoidal cells, twenty-six times in 51 cases of sphenoidal sinus disease, and six times in 33 antral cases. **Necrosis** may be found in connection with antrum suppuration, the inner wall, which consists of very thin bone, being most often affected. Bone changes are extremely rare in the frontal sinus, but they may occur even here (see Chap. XXI.). Grünwald found disease of the bone ten times in 22 cases, Hubert four times in 14 cases, while Lothrop, Avellis,¹ and myself have recorded other instances.

The changes occurring in the surrounding tissues and neighbourhood may be briefly summarised as follows: (a) Pus from any cavity, as the result of caries or necrosis of the bony walls, may find its way into other



FIG. 103.—A SPHENOIDAL SINUS SHOWING OSTEOPHYTIC GROWTHS.

spaces and infect them. From the antrum it may burst outwards into the soft tissues causing an abscess of the cheek, upwards into the orbit, backwards into the spheno-palatine fossa, or downwards through the hard palate or alveolar border into the mouth. From the frontal sinus the pus is most likely to find its way externally through the inner part of the roof of the orbit, or, more rarely, the posterior wall may be perforated and lead to meningitis or cerebral abscess. In ethmoidal disease the orbital plate of the ethmoid may be perforated, giving rise to cellulitis and abscess in the inner wall of the orbit. Perforation of the ethmoidal cells or of the sphenoidal sinus may also occur into the cerebral cavity and give rise to meningeal or cerebral infection. (b) Extension of the disease may also take place through the lymphatic channels, and perhaps through the veins, without any definite signs of bone disease. Some cases of cerebral complication may be produced by this method of extension. (c) The pus entering the nose produces a general catarrh of the mucous membrane, with oedematous swelling of the parts with

¹ *Archiv für Laryngol.*, 1895, ii. p. 303.

which it comes directly into contact: it is probably the occasional cause of osteitis and polypus formation (see Chap. XI.). (*d*) The discharge from the nose may cause excoriation of the anterior nares, with cracks or fissures and impetiginous crusts on the upper lip; occasionally erysipelas or an atypical pseudo-erysipelatous erythema of the face may arise, the streptococcus found in the nasal discharge being the probable exciting cause. (*e*) The pus entering the post-nasal space and pharynx produces a general catarrh of the entire upper respiratory tract. General pharyngitis and laryngitis are common. Attacks of septic tonsillitis, quinsy, or, more rarely, an acute retropharyngeal abscess may also be met with. (*f*) Important changes may be found in the lungs; chronic bronchitis is frequent, and may prove very obstinate. Probably bronchiectasis and foetid bronchitis may also be due to sinus suppuration. Kirkland related three cases of bronchitis and bronchiectasis in which rapid improvement followed the treatment of suppuration of the antrum. He considered the exact relationship of two cases, in which gangrene of the lung occurred in association with ethmoidal and sphenoidal sinus suppuration as more doubtful, although the changes in the lining membrane of the sinuses were similar to those in the lung.

Pneumonia has also been described as a complication of sinus suppuration: the evidence for and against this has already been discussed (see page 270). Patients with sinus suppurations often suffer from repeated mild attacks of pyrexia, of brief duration, associated with more or less definite signs of circumscribed pneumonia. The brief duration of the fever, the pneumonic symptoms, the expectoration of pus, the associated wasting and general ill-health frequently lead to an erroneous diagnosis of phthisis. I have seen several such cases which had been sent to various health resorts under this impression: all their symptoms vanished when the affected sinus was located and treated. The attacks are probably due to infection from the pneumococcus which is present in the pus from the sinus. Their mildness may be due to the fact that the patient has acquired a partial immunity to this organism.

General **acute septic absorption** is extremely rare but may follow operative interference. Reitter has recorded a case in which tonsillitis, pleurisy, and fatal peritonitis followed the removal of nasal polypi in antral suppuration. Acute osteomyelitis of the bones of the skull has been started by operation upon the ethmoidal and the frontal sinuses. Septic thrombosis of the cavernous sinus is very rare; mild septic infection of the lymphatic glands in the neck is not uncommon.

Dyspeptic troubles, probably due in part to pus trickling down the back of the nose and being swallowed, are common. Anaemia and general debility due in part to dyspepsia and in part to chronic absorption of the septic products, are also common.

The **cerebral complications** of sinus suppuration comprise the various forms of septic meningitis, encephalitis, abscess of the frontal lobe

of the brain, affections of the optic tracts and septic thrombosis of the cavernous sinuses. They are all rare. Denker has collected 21 cases of abscess of the frontal lobe and added one observation of his own. In some cases there was a perforation of the posterior wall of the frontal sinus: in others no trace of bone disease could be detected. Since this report a few single cases have been recorded.

Thrombosis of the cavernous sinus is extremely rare. It gives rise to headache, vertigo, vomiting, high temperature with rigors and general malaise. The affection is usually acute, and the patient is soon severely ill. Diplopia is an early symptom and is followed by oedema of the



FIG. 104.—THROMBOSIS OF THE CAVERNOUS SINUS. (From a photograph kindly lent by Dr. StClair Thomson.)

eye-lids and conjunctiva, proptosis and squint. The movements of the eyeballs become restricted, the whole face may appear swollen (see Fig. 104). Optic neuritis followed by optic atrophy and blindness may result from involvement of one or both optic nerves in connection with disease of the sphenoidal or posterior ethmoidal cells. Hemianopia has also been noted, as the result of sphenoidal sinus disease involving the optic commissure.¹ Onodi states that the optic nerve may come into relationship with the posterior ethmoidal cells or the sphenoidal sinus. It is separated from the former by a thin plate of bone, from the latter by a wall of varying thickness. A single ethmoidal cell may be in close relationship with both optic nerves or the chiasma. Thus the relationships vary and are seldom the same on both sides. He considers bilateral optic neuritis is mostly due to intracranial causes and very rarely

¹ Glegg and Hay, *Archiv für Laryngol.*, 1905, xvii. p. 525.

to nasal disease ; unilateral optic neuritis may be due to disease in either the sphenoidal or posterior ethmoidal sinuses.

The following works may be consulted :

- KIRKLAND AND STACY. *Journ. of Laryngol.*, 1902, xvii. p. 561.
 MACKIE. *Journ. of Laryngol.*, 1901, xvi. p. 581.
 LAPALIE. *Journ. of Laryngol.*, 1900, xv. p. 92.
 LICHTWITZ. *Journ. of Laryngol.*, 1895, ix. p. 862.
 LICHTWITZ. *Annales des Maladies de l'Oreille*, etc., 1899, xxv. p. 461.
 LICHTWITZ. *Annales des Maladies de l'Oreille*, etc., 1896, xxii. p. 113.
 ZIEM. *Journ. of Laryngol.*, 1895, ix. pp. 725, 783 and 855.
 CRYER. *Journ. Amer. Med. Assoc.*, 1900, November.
 ENGELMANN. *Archiv für Laryngol.*, 1894, i. p. 291.
 MINDER. *Archiv für Laryngol.*, 1902, xii. p. 328.
 WERTHEIM. *Archiv für Laryngol.*, 1900, xi. p. 169.
 HERZFELD AND HERRMANN. *Archiv für Laryngol.*, 1895, iii. p. 183.
 DMOCHOWSKI. *Archiv für Laryngol.*, 1895, iii. p. 255.
 LAMB. *Journ. of Laryngol.*, 1897, xii. p. 452.
 A general discussion on. *Journ. of Laryngol.*, 1895, ix. p. 629.
 LEWIS AND TURNER. *Edinb. Med. Journ.*, 1905, p. 393.
 ESCHWEILER. *Archiv. für Laryngol.*, 1905, xvii. p. 437.

Cavernous Sinus Thrombosis.

- LODGE. *Journ. of Laryngol.*, 1904, xix. p. 4.
 HANSELL. *Med. and Surg. Reporter*, 1896, July 25.
 FINLAY. *Montreal Med. Journ.*, 1898, xxvii. p. 822.
 WHITEHEAD. *Journ. of Laryngol.*, 1904, xix. p. 179.

Cerebral Abscess and Meningitis.

- GERBER. *Archiv für Laryngol.*, 1904, xvi. p. 208.
 PAUNZ. *Archiv für Laryngol.*, 1903, xiii. p. 427.
 DENKER. *Archiv für Laryngol.*, 1900, xi. p. 411.
 GRUENING. *Medical Record*, 1904, xv. p. 215.
 KNAPP. *Archives of Otol.*, 1903, xxxii. p. 181.
 REITTER. *Monatschr. für Ohrenheilk.*, 1902, Jan.
 DREYFUSS. *Die Krankheiten des Gehirns und seiner Adnexa im Gefolge von Naseneiterungen.* Jena, 1896 (pp. 6-91).
 ONODI. *Journ. of Laryngol.*, 1904, xix. p. 622.
 ONODI. *Archiv für Laryngol.*, 1905, xvii. p. 260.

CHAPTER XVI.

ACUTE SUPPURATION IN THE ACCESSORY CAVITIES.

SYMPTOMS AND TREATMENT.

THE **clinical history** of a case of acute suppuration is usually as follows:

A patient suffering from acute rhinitis due to an ordinary cold, to influenza, or to one of the other causes enumerated in the preceding chapter, experiences a sudden increase of the nasal symptoms. One or both nostrils become more stuffy, or completely obstructed, and there is a feeling of burning heat with great fulness or tension in the nose and over the neighbourhood of the affected cavity. This is increased by stooping or lowering the head, by coughing, straining, etc. There is usually much headache, most severe in the supra-orbital region, but radiating over the vertex. In unilateral cases the pain is generally limited to the affected side. It is often of a throbbing character, and gradually increases in severity. There may also be severe neuralgia, not only in the affected part, but shooting along the branches of the trigeminal nerve. The exact distribution of the pain varies according to the sinus affected, as do also the areas of superficial and deep tenderness (see Chap. XVII.). In the more severe cases there are constitutional disturbances, malaise, fever, and anorexia; the patient may feel acutely ill; the walls of the cavity become tender on pressure or percussion and may bulge; the soft tissues overlying them may become red, swollen and oedematous. Examination of the nose shows evidence of acute rhinitis, redness, vascular engorgement of the inferior turbinate, and oedema of the tissues in the upper part of the nose. The middle turbinate is almost invariably swollen and tender to the touch. When one of the anterior set of accessory sinuses is affected, if the swollen turbinates permit a view, an oedematous swelling may be seen on the outer wall of the nose in the neighbourhood of the uncinate process: when the antrum is affected the whole outer wall of the nose may appear to be pushed inwards. After a few hours or days of increasing suffering a sudden gush of discharge takes place from the nostril, consisting of mucus, muco-pus, or pus mixed, in the majority of cases, with more or less blood, and the symptoms are immediately relieved.

The subsequent history varies. Sometimes all symptoms permanently disappear after the initial discharge: in other cases an intermittent discharge may continue for a few hours, and gradually decrease until complete cessation occurs. Or, after a brief interval all the symptoms may return and slowly increase in severity until a second discharge takes place. This cycle of events may be repeated once, twice or oftener, and then may result in complete recovery or, finally, the case may become chronic. Patients who have once suffered in this way are liable to have a repetition of the attacks, probably because of some predisposing anatomical peculiarities. Some patients have acute antral suppuration every time they take a fresh cold (see page 273).

Diagnosis. The diagnosis is readily made by careful attention to the above history. The chief points to be attended to are the presence or history of an acute rhinitis, of influenza, of a bad tooth or of other exciting cause, the acute onset, the increasing severity of the symptoms, and the immediate relief following a sudden escape of discharge from the nose. The course of these symptoms is pathognomonic of an acute affection of one or other of the sinuses, though it may not be possible to say of which, unless definite local tenderness or swelling is present. The evidence to be obtained from the situation of the pus in the nose and from such means as transillumination and puncture, will be considered in Chapter XVIII.

The affection most frequently confused with acute antral suppuration is acute osteomyelitis of the upper jaw. Instances of this affection are frequently recorded in the medical journals as cases of antral suppuration occurring at an unusually early age, for the disease is most common in infants and young children. Antral suppuration at these ages is practically unknown: moreover the situation of the external abscesses or fistulae which may form is also characteristic (see Chap. XVIII.).

I have seen one case, possibly unique, in which a foreign body in the nose simulated sinus suppuration. The patient was an adult who stated that pieces of food occasionally entered his nose without any apparent cause and gave rise to the complete cycle of events above related. There was increasing unilateral nasal obstruction and discharge, a painful feeling of tension, burning, and throbbing in the nose, severe facial neuralgia gradually increasing in intensity until all the symptoms terminated suddenly with the expulsion of pus and blood from the affected nostril. A history of similar attacks was given, and the case was looked upon as one of acute suppuration in the antrum until it was noticed that pieces of food were invariably present in the discharge.

Treatment. The main objects of treatment are to cut short the inflammatory disturbance, and to reduce the swelling in the nose so as to allow a free escape for the pent-up discharge. These objects are best attained by employing both constitutional and local measures. The disease tends towards spontaneous cure, but much can be done to hasten this and

thus to minimise the danger of secondary changes occurring in the affected cavity, which might lead to the suppuration becoming chronic.

The patient should be kept in an even temperature, preferably confined to bed, and a brisk purge followed by a diaphoretic mixture should be administered: in fact, he should be treated on the same lines as for a severe cold (see page 129). A simple warm, alkaline lotion should be used frequently to wash out the nose; if the nose and throat be acutely inflamed hot steam inhalations containing menthol often give great relief. When symptoms occur pointing to the presence of pent-up matter in a sinus, local measures must be adopted to reduce the swelling of the mucous membrane and remove the obstruction around the outlet of the affected cavity.

The application of a powerful astringent, such as a strong solution of **cocaine and suprarenal extract**, to the nasal mucous membrane may first be tried. Pledgets of wool soaked in the solution should be carefully packed around the ostium of the affected sinus. When this is done successfully, the mucous membrane becomes anaemic and shrunken, and almost at once discharge from the cavity commences. If the antrum be affected the evacuation may be facilitated by bending the patient's head forward or to the opposite side. This application, both by its astringent and anaesthetic action, usually gives great relief. The great disadvantages are that the astringent effect is only temporary, and that the swelling tends to recur as the effect of the drug passes off. If, however, complete evacuation of the discharge has been obtained there is usually no further trouble. After having emptied the cavity, the astringent action on the mucous membrane may be kept up by menthol, which also acts as a mild anaesthetic. It is best applied as an oily spray, a $1\frac{1}{2}$ -3 per cent. solution of menthol in olive oil or paroleine being introduced into the nose with an atomiser. Other astringents, such as antipyrin and hazelin, in watery solution are used by many for a similar purpose: they are more irritating than menthol, and have no particular advantages.

Should these measures fail to reduce the oedema sufficiently, or should it rapidly recur, the most effective and rapid means at our disposal is **local blood-letting**. This is a remedy I have never seen advocated for this condition, but in my hands it has proved the most successful means of treatment. When there is acute suppuration in one of the anterior set of cavities, such as the antrum or frontal sinus, free incisions should be made along the middle turbinate and along the outer wall of the nose just below the opening of the sinuses. These simple incisions made with a sharp knife allow the tissues to drain freely, and are apparently more effective than the removal of pieces of mucous membrane with punch forceps. By the latter method pieces of bone may also be removed, and the door opened up to infection: this may be followed by increased swelling and oedema.

In conjunction with these methods of treatment **hot fomentations**

should always be applied externally over the affected cavity: they are probably a useful aid in reducing the swelling, and prove very grateful to the patient. Further, any polypus or hypertrophy in the nose should be removed, and occasionally, when the middle turbinate is much swollen and pressed against the septum, it may be necessary to amputate the anterior part or the whole of it, but the effect of free incisions should be first tried.

If these means fail more active measures must be adopted to secure the evacuation of the cavity. It has been recommended to attempt this by reducing the air pressure in the nose, as by sniffing as hard as possible with closed nostrils¹ or by producing suction with a modification of Politzer's bag. I have had no personal experience of these methods, but they seem likely to increase the swelling and oedema in the nose by causing a partial vacuum, whilst they could hardly be effectual in sucking out pus from any of the cavities, except, possibly, from the frontal sinus. The ordinary method of inflation with a Politzer bag seems likely to be dangerous as well as ineffective, for should pus be present in the infundibulum or in the cleft under the middle turbinate it seems quite possible to blow it into a healthy sinus and thereby cause a spread of infection. Also, there is a danger of infecting the middle ear through the Eustachian tube. For this very reason some authors, for instance Grünwald, recommend that even blowing the nose should be avoided as far as possible, or should be performed quite gently. If, then, the above treatment fails it is better to adopt at once more certain measures to secure evacuation of the cavity. This may be done by aspirating it, or by washing it out either through its natural opening or through a small puncture.

The Maxillary Antrum. When the above treatment has failed, this cavity should be punctured and the contents washed out by irrigation with a mild antiseptic lotion, such as a solution of boracic acid. The various methods of doing this and the advantages and disadvantages attaching to each will be fully discussed later (see Chap. XIX.). If the affection be of dental origin the carious tooth should be at once removed and the antrum perforated through its socket. After thoroughly washing out the cavity a small plug should be inserted in the hole to prevent its closure, and the irrigation repeated daily until all discharge has ceased. As a rule there is no pus after the first washing, but it may continue a few days; in acute cases it is very rare not to obtain a rapid cure. If there be no dental trouble it is better to perforate the antrum from the inferior meatus of the nose with a Lichtwitz's trochar and cannula. A single irrigation is often sufficient to effect a cure, but it may have to be repeated in a day or two. Should these measures fail the case must be treated on the lines laid down for chronic suppuration (see Chap. XIX.).

The Ethmoidal Cells. If any of the ethmoidal cells are affected the

¹ Moll, *Journ. of Laryngol.*, 1896, x. p. 333.

best treatment is to open them at once. This may be accomplished by breaking into a cell with a Hajek's hook and then cutting away its floor, preferably with a pair of punch forceps such as Grünwald's (see Chap. XX.).

The Frontal Sinus. The approach to the lower part of the infundibulum should first be cleared in the way above described, and then the anterior end, or whole of the middle turbinate, together with any thickening or swelling of the adjacent part of the outer wall of the nose, should be removed. Simple irrigations, menthol spray or inhalation, and such like treatment must be carefully practised. A cautious attempt may be made to introduce a suitably-bent cannula into the sinus, but no force must be used and especially no attempt must be made to puncture its floor from the nose. Should a cannula be successfully introduced the sinus may be irrigated, but should this prove impossible, and from anatomical considerations it has been shown how very likely it is to be so, the case must be left to nature for a time. The frontal sinus from the dependent position of its opening usually recovers spontaneously or by the use of the simple means already advised.

An acute suppuration in the **sphenoidal sinus**, should it ever be recognised, must be treated on similar principles, the approach to it being cleared by the removal of the middle turbinate, and the sinus irrigated through its natural opening.

The following articles may be consulted :

AVELLIS. Archiv für Laryngol., 1896, iv. p. 255.

AVELLIS. Münch. med. Woch., 1896, xliii. p. 720.

AVELLIS. Archiv für Laryngol., 1900, x. p. 271.

WROBLEWSKI. Archiv für Laryngol., 1900, x. p. 52.

CHAPTER XVII.

SYMPTOMS OF CHRONIC SUPPURATION IN THE ACCESSORY SINUSES.

THE symptoms of chronic suppuration in the accessory cavities of the nose vary greatly. Sometimes they are intense and call for urgent relief; at others almost insignificant. Moreover they often show great variations in degree at different times in the same patient, acute exacerbations alternating with long or short periods of remission or almost complete intermission. This periodicity is so common as to be almost characteristic. The severity of the symptoms depends upon whether the opening of the sinus into the nose is patent or more or less occluded; that is upon whether there is a free or obstructed outlet for the discharge. When the outlet is free the symptoms are less marked and the empyema is described as *latent*; in contra-distinction an empyema is termed *manifest* when the outlet is blocked and symptoms of retention are present. In the latter case the local symptoms are often very severe. On the other hand, a patient may complain of some symptom only remotely connected with the nose, and the presence of sinus suppuration may be discovered accidentally or as a result of routine examination. To avoid repetition, in describing the symptoms of sinus suppuration generally, I shall at the same time indicate those which point more or less to an affection of one particular cavity, and endeavour to ascribe to each symptom its diagnostic value.

The symptoms of **latent empyema** may be divided into the subjective, the objective, and the remote. Prominent amongst the subjective symptoms are (1) pain, which may take the form of headache or neuralgia, and may be localised or radiate in various directions; (2) tenderness, local or referred, superficial or deep; (3) anosmia or parosmia; and (4) various mental phenomena such as mental depression, neurasthenia, inability to fix the attention or to undertake mental work, irritability of temper. Amongst the most prominent of the objective symptoms may be mentioned (1) discharge from the nose, which may be slight or profuse, constant or periodical, and with or without foetor, and (2) nasal obstruction due to polypi or oedema of the nasal mucous membrane.

DISEASES OF THE NOSE.

The remote symptoms may be enumerated septic or catarrhal of the pharynx and larynx, excoriation of the anterior nares of the upper lip, impetiginous eruptions on the face, chronic gastritis, affections of the eyes and ears, and impairment of the general health. The complications of sinus suppuration include abscess of the cheek or hard palate from antral suppuration, orbital abscess and cellulitis, meningitis and cerebral abscess, etc. They generally result from caries or necrosis of the sinus walls or from infection conveyed by the efferent veins or lymphatics.

Manifest Empyema. When the opening from the sinus into the nose is blocked and the empyema becomes *closed* or *manifest*, the patient exhibits severe symptoms due to retention of pus. They are similar to those of an acute abscess: severe throbbing pain in the affected region, swelling, redness and oedema of the overlying soft parts and signs of septic absorption, fever, rapid pulse, anorexia and general constitutional disturbance. These symptoms readily enable a diagnosis to be made, and they require no further discussion. As a rule the symptoms characteristic of latent empyema are also present, but when there is complete obstruction to the overflow of pus into the nose, there may be no sign of intra-nasal disease.

The symptoms which may occur in **latent empyema** require detailed consideration.

Pain. Pain is an important but by no means constant feature. It may indeed be absent throughout the whole course of the disease, especially when the antrum or the sphenoidal sinus is affected. On the other hand it may be intense and take the form of headache or neuralgia.

Headache is often present but varies much; it may have a periodic character, commencing on, or soon after, rising in the morning, gradually increasing in severity for an hour or more, until a sudden discharge of matter takes place from the nose, when the pain at once subsides. This periodicity is characteristic of a sinus affection, but in no way indicates which cavity is involved. The pain is more intense during acute exacerbations such as may arise when the patient contracts an acute cold or when from some other cause the outlet of the sinus is temporarily obstructed: in the intervals it may be entirely absent. Headache is made noticeably worse by excessive indulgence in tobacco or in alcohol, and by fatigue, mental or bodily.

The pain may be situated in the supra-orbital region, or referred to the back of the eyes, the top or the back of the head; when severe it is usually diffuse, but most intense in one area. It may be described as a dull, heavy ache, or a feeling of a weight on the head, or as acute neuralgia. It is generally most severe on the affected side, but true hemicrania is rarely due to sinus trouble. Grünwald, however, reports four cases in which he has cured hemicrania by treating sinus suppuration. Hajek has never seen a cure of true hemicrania, although he has obtained

improvement, and thinks this form of headache more often due to hypertrophic rhinitis. Genuine *tic douloureux* is never seen. Care must, of course, be taken when the patient complains of local or diffuse headache that no other concurrent cause is present; thus Hajek and Fliess report cases in which a headache due to a general cause such as chronic nephritis has been treated as of nasal origin. Still, the opposite error is far more often made, and many cases of headache are ascribed to some nervous origin, whilst the true cause of the trouble remains unsuspected because other nasal symptoms are passing or slight. A diagnosis of nervous headache should never be made until a thorough examination of the nose has excluded every nasal cause. The typical recurrent, intermittent, neuralgic headache after influenza almost always indicates sinus suppuration.

Although the site of the pain affords but little indication as to which sinus is affected, the following points may be noted:

In **acute antral disease**, such as may occur in influenza, there is often pain in the infra-orbital region, over the malar bone and in the teeth of the upper jaw. There may be an intensely painful spot midway between the outer angle of the orbit and the tragus. In the more chronic cases pain, if present, is usually most intense over the side of the nose and the nasal process of the frontal bone, but may radiate into the supra-orbital and infra-orbital regions. Killian, Hartmann, and Hajek, all lay stress upon the fact that pain may occur in the supra-orbital region, and give various explanations of it. Killian says pain in this region indicates that the frontal sinus is also involved. Hartmann regards it as evidence of obstruction of the infundibulum or of the ostium of the frontal sinus, due to the swelling of the tissues in the middle meatus. Hajek states that this symptom only shows the uncertainty attached to the localisation of the pain. I have frequently met with cases in which supra-orbital pain and tenderness were present, and yet the antrum was the only sinus affected. In two of these I have actually seen the frontal sinus opened, and proved to be healthy. Other similar cases are reported. I believe that this pain is really due to nothing else than enlargement of the middle turbinate. As already related, acute pain over the side of the nose and in the supra-orbital region may result from enlargement of the anterior end of the middle turbinate, and this condition is frequently present in, and is probably a consequence of, antral suppuration (see page 88).

In **frontal sinus** disease, pain is more frequent, and probably more severe, than in affections of the other sinuses. It is usually most marked over the top of the head, but may radiate into the supra-orbital and infra-orbital regions and towards the back of the eye. It is often described as a dull heavy weight pressing on the head. It may also spread to the temporal region and occasionally to the opposite side. When there is obstruction of the infundibulum or disease of the bony walls the pain is localised to the sinus, and is usually most intense over its inferior wall.

Although pain is frequently present, it may be absent, and is generally intermittent or periodic. Thus the patient may complain of pain commencing in the early morning, or during the forenoon, and gradually increasing for one, two or three hours until it becomes almost maddening in character, and then gradually passing off, with or without profuse discharge. In other cases from various causes, such as catching a slight cold, from overwork, fatigue or indulgence in alcohol, a severe attack of headache lasting two or three days may ensue and completely prostrate the patient.

In **ethmoidal cell** disease pain is perhaps most often absent. When present it may consist of a slight dull aching feeling between the eyes and on the top of the head; in rare cases it may be very severe. In the latter case the region affected is as a rule similar to that involved in frontal sinus suppuration, and indeed both affections are very commonly associated.

In suppuration in the **sphenoidal sinus**, pain when present, is usually referred to the back of the head or neck; or it may be located deep in the head, at the back of the nose, or behind the eyes. Occasionally acute recurrent attacks of pain are met with, associated with stiffness of the neck, and occasionally with vertigo. Pain in the supra-orbital or temporal region is rare. An acute onset of severe headache situated deeply in the head, together with sudden blindness, may be met with, and is almost pathognomonic of sphenoidal sinus disease. In most cases pain is altogether absent.

Tenderness. Tenderness is a very variable symptom, and often absent. In **antral** suppuration it may be elicited by percussion over the malar bone, over the nasal process of the frontal bone, and in the supra-orbital region. The tenderness in these last regions (see Fig. 56) is frequently superficial—skin tenderness—and is probably due to enlargement of the middle turbinate. It is also met with in suppuration of the frontal sinus or ethmoidal cells, in both of which enlargement of the middle turbinate is common. Hajek and others consider tenderness in the supra-orbital region indicates disease of the frontal sinus. Repeated observations have convinced me that this is a mistake, and that this symptom does not depend on sinus suppuration at all, but is due to pressure of an enlarged middle turbinate against the septum (see page 89). Deep tenderness over the cheek and in the canine fossa is rare, and only occurs in acute suppuration, when the outer wall of the antrum is diseased, or when complications such as inflammation of the cheek are present.

In **frontal sinus** suppuration, in addition to the region already indicated, tenderness may sometimes be elicited on the top of the head over the posterior part of the frontal bone, and occasionally by upward pressure on the inner portion of the inferior wall of the sinus. Hajek states that the latter symptom is always obtainable. In my experience it is not common but when marked it is undoubtedly of great diagnostic value.

When the bony walls of the sinus are affected or when there is inflammation of the overlying tissues local tenderness may of course be obtained.

In **ethmoidal cell** disease, tenderness may be elicited over the nasal process of the superior maxilla, in the supra-orbital region or on the vertex. Grünwald lays stress on the value of tenderness over the lachrymal bone, but this, according to Hajek, is often absent. Owing to the normal sensitiveness of this region I have found it extremely difficult to make certain of this symptom.

The situation and extent of superficial tenderness in connection with disease of the sinuses has yet to be worked out. At present our knowledge of the exact localisation of pain and tenderness in connection with nasal diseases is too vague for these symptoms to afford much assistance in diagnosis.

Discharge. The discharge from the nose may be profuse or slight and may consist of mucus, muco-pus or almost pure pus. Occasionally it is thin, but more often thick, and may contain caseous particles or curdy masses. In antral suppuration it is often profuse, and may be the first symptom to attract the patient's attention. The discharge may be slight during the quiescent intervals and profuse when the patient takes cold. Often it is so slight that the patient denies its existence or asserts that he has only a slight cold in the head. When profuse the discharge is fluid, when scanty it may dry and form crusts. When profuse it usually comes, at any rate in part, from the anterior nares, but quite often it goes backwards into the post-nasal space only. This is true not only of suppuration in the sphenoidal sinus and in the posterior ethmoidal cells, but also of suppuration in the anterior set of cavities. Cases of antral suppuration are frequently met with in which the patient complains only of hawking up phlegm from the throat and will not admit that he has any nasal discharge, even on cross-examination.¹ This has been ascribed to the fact that enlargement of the anterior end of the middle turbinate or polypus or other obstruction has been present, which has prevented the discharge coming forward. It seems to me, however, that the ciliary movements of the nasal epithelium afford a much more satisfactory explanation. The discharge from the nose is normally swept backwards into the post-nasal space, and if the cilia be not damaged, if the discharge be not too profuse, and if no obstruction exist, the pus from a sinus, even from one of the anterior set, would naturally be carried backwards in this direction. I have certainly met with many cases of antral suppuration in which there has been no obstruction to the outflow of the discharge in an anterior direction, and yet all the matter has gone backwards into the throat. It is my distinct impression that this symptom is far more often met with when there is no polypus or other cause of obstruction in the middle meatus. Thus it must be distinctly borne in mind that pus from the anterior set of sinuses may appear only in the

¹ See also Brady, *Journ. of Laryngol.*, 1899, xiv. p. 565.

post-nasal space. Much less frequently discharge from the posterior ethmoidal cells or even from the sphenoidal sinus may run forward into the anterior part of the nose and appear to come from the middle meatus. In spite of these facts the position of the discharge affords evidence of considerable diagnostic value. If a bead of pus be constantly seen in the upper part of the middle meatus, and if it reappears in this position after having been wiped away, suppuration in the anterior set of sinuses may be confidently diagnosed. If, after thoroughly cleansing the middle meatus, pus reappears in this position only on lowering the head or on bending it well forward antral suppuration should be suspected. On the other hand, when the pus appears in the olfactory cleft, and constantly reappears in this position after being wiped away, it points to affection of the posterior ethmoidal cells or sphenoidal sinus. Also when on post-rhinal examination a small crust of pus or muco-pus is repeatedly seen on the roof of the post-nasal space, or on the upper surface of the middle or superior turbinate, it is strongly suggestive of affection of the posterior set of cavities, the discharge from which is often scanty and has a great tendency to form crusts. When the nasal fossae are unduly wide, the purulent secretion may dry up and the interior of the nose may be lined by crusts which closely resemble those in ozaena (see page 161).

Periodicity of Discharge. The discharge is generally more or less intermittent: sometimes it occurs only on first rising in the morning, having accumulated whilst the patient was in a recumbent position. Sometimes there is a feeling of fulness or tension in the nose or cheek, gradually increasing for a few hours and then relieved by discharge. Such symptoms are pathognomonic of sinus suppuration. Or again, the patient may remark that pus flows into the nose on bending the head forward, as on stooping, a symptom suggestive of antral affection. When pus continually trickles into the nose in the upright position, affection of the ethmoidal cells or frontal sinus is indicated. When the discharge is very profuse, it probably arises from a large cavity such as the antrum or from more than one sinus.

Foetor of Discharge. In suppuration of the maxillary antrum the patient frequently complains of a bad smell in the nose, which may be very intense and compel him to seek advice. When the ethmoidal cells are affected alone, or in conjunction with other sinuses, the perception of smell is usually impaired or lost. The foetor of the discharge is not often noticeable to others unless they come into close contact with the patient, and it is never so intense as in atrophic rhinitis or syphilitic necrosis. Still, a peculiar, heavy, very disagreeable odour may be noticed if sought for, especially in cases of antral disease. When the discharge dries, as it may do when the nostrils are unduly wide, the crusts and foetor may closely resemble ozaena (see page 161).

Nasal Obstruction. Many patients apply for relief on account of difficulty in breathing through the nose. This may be due to the presence

of polypi or of hypertrophic rhinitis, or simply to general congestion and oedema of the nasal mucous membrane, and it is only on examining the nose that the presence of pus is discovered and sinus suppuration suspected. The various effects of nasal obstruction, such as congestion and dryness of the pharynx and larynx, post-nasal catarrh, etc., may result.

Polypi and Oedematous Hypertrophies. Sinus suppuration, especially when of long standing, is almost invariably accompanied by changes in the nasal mucous membrane, such as the formation of polypi or oedematous hypertrophies, the extent and situation of which are a valuable clue to the localisation of the disease. When the anterior set of sinuses alone is involved, these changes are limited to the middle meatus and to the under surface of the middle turbinate. Oedema in this region often gives rise to an appearance of "cleavage" of the middle turbinate. This is met with in suppuration in all of the anterior cavities, and is not, as was formerly supposed, pathognomonic of antrum suppuration. It appears at first sight as if the middle turbinate were split longitudinally and that pus oozed down from the cleft, but on careful examination with the probe, aided by cocaine, it will be found that the body lying next the nasal septum is the true middle turbinate, and that the swelling on the outer side is an oedematous hypertrophy of the uncinate process or of the outer wall of the nose caused by the constant irritation of pus trickling over it. Polypi limited to the middle meatus indicate suppuration in one of the anterior sinuses. Frontal sinus and ethmoidal cell suppuration are almost invariably accompanied by polypi; in antral suppuration, especially when due to dental causes, these growths are usually absent. In a similar way polypus, or oedema, in the upper or posterior part of the nose or affecting the upper surface of the middle turbinate only, indicates disease in the posterior set of accessory cavities.

Redness and Swelling. Occasionally fleeting redness and swelling may appear over the site of an affected cavity, especially when from any cause there is an acute exacerbation of the symptoms. These signs, although rare, are of great importance, as they definitely localise the seat of the affection, and also sometimes precede disease and perforation of the bony wall of the sinus.

Loss of Smell and Taste. Patients often complain of anosmia. Sometimes this is due to catarrh of the olfactory region, but more often to obstructions, such as polypi or oedema of the middle turbinate, blocking the olfactory cleft and hindering the approach of the olfactory particles. Loss of taste due to anosmia, or a nasty taste in the mouth due to the entrance of pus into the post-nasal space and pharynx, is common.

Remote Symptoms. The effects of sinus suppuration upon the pharynx, larynx, trachea, and even the lungs, have only recently been recognised. Patients frequently seek advice for symptoms implicating these regions, and the existence of nasal trouble is overlooked not only by the patient, but by his doctor. An intractable form of chronic

laryngitis, associated with peculiar oedematous thickening of the mucous membrane of the ventricular bands, vocal cords, and especially of the inter-arytenoid folds, is very common. Chronic tracheitis, bronchitis, and even bronchiectasis may be the direct consequence of the nasal disease. Pus trickling down into the pharynx may give rise to local septic affections, such as an acute post-pharyngeal abscess, recurring attacks of quinsy, or septic tonsillitis. The discharge coming forward through the anterior nares causes excoriation of the anterior nares and of the upper lip; impetiginous crusts may be seen not only in this region, but over the whole face. Little cracks or fissures may also form around the nares and allow the entrance of the specific micro-organisms. In this way, if the pus from the sinus contain streptococci, repeated attacks of erysipelas, or more often of a pseudo-erysipelatous erythema, may be set up. Again, the pus and discharge from the nose may be swallowed and give rise to more or less severe gastritis and disturbance of the alimentary canal.

Sometimes patients seek advice for **affections of the ear**, such as Eustachian obstruction and suppurative or non-suppurative middle ear disease. It has been stated that tinnitus may be due solely to antrum suppuration, and the true cause may be easily overlooked unless carefully sought for.¹ Other patients seek relief for weakness of the **eyes**, for dimness of vision, asthenopia, or for conjunctival discharge and blepharitis. In such cases nothing but a systematic examination of the nose can prevent errors of diagnosis.

Signs of **acute septic absorption** are very uncommon, but occasionally there may be enlargement of the glands in the neck. Fever and other signs of constitutional disturbance may occur in closed or manifest empyema or when complications are present. Chronic septic absorption, as evidenced by pallor, anaemia, a muddy spotty complexion, general ill-health, lassitude, irritability of temper, capricious appetite, biliousness, dyspepsia and diarrhoea, is more common.

Various **mental phenomena** are frequently met with, but may be seen in other nasal diseases, especially those causing nasal obstruction, and afford no presumption of ethmoidal sinus disease, as is stated by Lermoyez, Hajek, and others. The most common form is mental depression, which may be so severe as to amount to hypochondria or melancholia. It is especially likely to occur when severe headaches or neuralgic pains are present. Patients often complain of inability to fix the attention, of mental dulness or stupidity, inability to undertake any mental work, and of great irritability of temper. These symptoms resemble the aprosexia of Guye. In other cases the patient is subject to congestion of the head and face, especially after meals or on taking alcohol or smoking. At such times the whole face may become congested, and the patient may be extremely excitable and irritable, his whole mental characteristics being altered. Vertigo is common in ethmoidal and sphenoidal sinus disease.

¹ Tilley, *Lancet*, 1904, i. 1415.

Impairment of the **general health** is frequently met with. It usually bears a direct relationship to the severity of the local symptoms. The disturbed rest from headaches and pain, the chronic absorption of septic products, may result in general anaemia, and often give rise to neurasthenia.

Complications. The local complications of suppuration in the accessory cavities arise from direct extension of the disease to the adjoining parts, either as the result of caries or necrosis of the sinus walls, or of infection conveyed by the lymphatics. An abscess in the cheek, in the alveolar margin, or in the hard palate may arise from caries or necrosis of the walls of the antrum, with extension of pus into the soft tissues. The evidence obtained with the probe or finger after opening the abscess, or the effect of syringing, will speedily determine the diagnosis. Abscess or cellulitis of the orbit may arise from antral, ethmoidal, or frontal sinus disease. An abscess in connection with the antrum usually appears in the floor or inner wall of the orbit; when arising from ethmoidal cell disease, in the inner wall of the orbit; whilst that due to frontal sinus disease is usually situated in the roof of the orbit, and points almost in the centre of the upper lid. Proptosis, displacement outward of the eyeball, with extensive oedema of the lids and conjunctiva, may be present. When the abscess is opened, the insertion of a probe or of the finger will indicate the primary source of disease. Meningitis or cerebral abscess may arise in connection with frontal, ethmoidal, or sphenoidal sinus suppuration. In the latter case infection of the cerebral cavity may be indicated by proptosis or oedema of the orbital tissues from obstruction of the cavernous sinuses, or by sudden onset of blindness with or without optic neuritis, due to involvement of the optic tract. Most of these complications arise from caries or necrosis of the walls of the cavity and direct extension through into the adjoining soft tissues. Cerebral complications may, however, take place without apparent disease of the sinus walls; in this case infection probably takes place through the small lymphatic vessels running along the walls of the veins, which establish a direct communication between the mucous membrane of the sinuses and the cerebral cavity.

CHAPTER XVIII.

THE DIAGNOSIS OF CHRONIC SUPPURATION IN THE ACCESSORY CAVITIES OF THE NOSE.

LATENT EMPYEMA.

WHEN external signs are present, that is when the empyema is manifest, the diagnosis is usually easy. In latent empyema, on the other hand, when a purulent discharge from the nose may be the only symptom, or when, indeed, even this may fail, the diagnosis is frequently a matter of considerable difficulty.

The **history** of the patient's illness must be carefully enquired into, and the presence or absence of the various symptoms described in the preceding chapter must be noted. The localisation of any pain or tenderness, or the peculiarities of the discharge, may not only establish a diagnosis of sinus suppuration, but may indicate the actual cavity which is affected. The evidence to be obtained from these sources has already been fully described.

Presence of Pus. The first step in the diagnosis is to ascertain the existence of a purulent discharge. Pus may be recognised by its opacity, its fluidity, and its lemon-yellow colour. Whenever pus is seen in the nose, or whenever there is a history of an intermittent or occasional discharge of mattery fluid—which history may be confirmed by examination of the patient's handkerchief, sinus suppuration should be suspected. If no pus be seen on the first occasion the examination must be repeated, cocaine and suprarenal extract applied to reduce the swelling of the nasal mucous membrane, and the patient's position varied by bending the head forward or to one side. When the discharge is scanty, it may readily dry up and form crusts. These should be removed with forceps, when a bead of pus may be seen immediately to well up. The necessity of repeated examinations must be emphasized, as owing to the neglect of this precaution it is probable that sinus suppuration is still frequently overlooked even by competent observers.

Other Sources of Pus. A purulent secretion from the nose may arise from other causes, such as the following: Tertiary syphilis, tuberculous disease including lupus, malignant disease, the presence of a foreign body

or sequestrum, acute suppurative rhinitis such as occurs in diphtheria and fibrinous rhinitis and ozaena. In some diseases of the naso-pharynx pus may also run forward into the nose. If these affections are borne in mind they can hardly fail to be recognised. Still it must be remembered that sinus suppuration may coexist with any of them. Thus syphilitic disease of the outer wall of the nose may lead to necrosis of the antro-meatal septum, and consequent infection of the antral cavity, and a similar result may occur in tuberculosis and malignant disease. As already shown, acute purulent rhinitis and ozaena are common causes of sinus suppuration.

Origin of the Discharge. Having determined the presence of pus in the nose, the next point is to make certain of the spot at which the discharge first appears. Of course pus gravitates and therefore is frequently seen forming a pool on the floor of the inferior meatus, or, as already stated, the discharge may take place entirely into the post-nasal space. Still, with careful and repeated examinations, a thin streak of pus can often be traced running up the septum or outer wall of the nose, towards the orifice of one of the accessory cavities. If the streak of pus proceeds from the middle meatus, and if this appearance is seen on repeated examinations at different periods, sinus suppuration is present. If even a mere bead of pus is repeatedly seen issuing from the middle meatus, the existence of sinus trouble is almost certain. Further, in a very large majority of cases pus in the middle meatus has come from the antrum, the frontal sinus, or the anterior ethmoidal cells. The discharge from the sphenoidal sinus and posterior ethmoidal cells is rarely seen in this position and never repeatedly. Pus appearing in the olfactory cleft, that is between the middle turbinate and the septum, points to posterior ethmoidal or sphenoidal sinus disease. The probability of the latter is greatly increased if, on post-rhinoscopic examination, pus is seen lying on the posterior ends of the superior and middle turbinates and on the anterior surface of the sphenoid. The diagnostic value of the amount, of the foetor and of the periodicity of the discharge has already been discussed. (See page 293.)

Re-appearance of Discharge. The next step is carefully to wipe away every trace of discharge, and then to note when and where the pus reappears. If it is repeatedly replaced in the middle meatus within a short time after mopping it away, in all probability either the frontal sinus or the ethmoidal cells are affected. If, however, the pus does not re-appear while the patient sits upright, but does when his head is lowered or bent over towards the opposite side, then the probabilities are in favour of the antrum being affected. The situation of the outlets of the cavities explains this phenomenon. The opening of the antrum being situated at the highest part of the cavity, pus cannot overflow until the sinus is completely filled, or until the relationship between the sinus and its opening has been altered. On the other hand, the openings of the frontal sinus and ethmoidal cells are near the lower part of the cavities, and therefore pus will constantly

drain away. The re-appearance of the discharge on lowering the patient's head in cases of antral suppuration, sometimes known as Fränkel's sign, was previously described by Spencer Watson.

Localisation of Oedema. The next point is to note carefully the existence and situation of any polypi, hypertrophies, swelling, or oedema of the mucous membrane. Swelling on the outer surface of the middle turbinate or adjacent part of the wall of the nose, and granulations protruding from the middle meatus, point to affection of one of the anterior set of sinuses. In this condition the pus frequently seems to issue from a cleft in the middle turbinate; in rare cases this is actually the case, the floor of an enlarged suppurating cell in the anterior end of the middle turbinate having given way. The probe introduced into the opening whence the pus exudes meets with bare, friable bone. More usually, however, the mass forming the inner boundary of the "cleft" is the middle turbinate, and the outer part of the cleft is formed by inflammatory swelling of the uncinat process or of the bulla ethmoidalis. This condition was formerly considered pathognomonic of antral suppuration,¹ but it is frequently seen in suppuration of the frontal sinus and ethmoidal cells. On the other hand, if the oedema of the nasal mucous membrane be limited to the inner or upper surface of the middle turbinate, and to the corresponding part of the septum, suppuration in the posterior set of sinuses should be suspected. In affections of these latter sinuses, a patch of oedema is often seen on the septum, near the anterior end of the middle turbinate, a spot on which the discharge is apt to collect, and, when not very profuse, to dry and form crusts.

Polypus is of similar significance, and may be found in association with suppuration in any of the cavities. When limited to the middle meatus of the nose it is usually associated with suppuration in one of the anterior set of cavities, and when limited to the posterior and upper part of the nose, with suppuration in one of the posterior cavities. When multiple polypi, or when numerous small, oedematous, granulation-like growths are present in the ethmoidal region with pus exuding between them, I believe suppuration will invariably be found in the ethmoidal cells, with or without accompanying disease in other sinuses. It is extremely rare for polypi actually to protrude from one of the accessory sinuses into the nose, except from the ethmoidal cells. It is, indeed, hardly possible, unless the wall of the sinus has given way. Oedema of the anterior surface of the sphenoid is a positive indication of suppuration in the sphenoidal sinus.

Bone Changes, Caries or Necrosis. Pathological changes in the bones, apart from the rarifying osteitis associated with nasal polypus, are uncommon even in long standing sinus suppuration. The diagnosis requires to be made with the greatest care. A blunt probe must be used, as the mucous membrane overlying the ethmoid is extremely thin, and easily perforated by a sharp instrument. Care must also be taken that the probe

¹ MacDonald, *Diseases of the Nose*, London, 1892, p. 169.

does not touch the nasal speculum, as this may communicate a grating feeling to the hand. Cocaine should be applied to the nose, and the probe gently passed in the direction from which the pus appears to come, when distinctly bare rough spots of bone may occasionally be felt. They may be found in any part of the nose with which the pus constantly comes in contact. The detection of extensive caries, or of a sequestrum, would point strongly to syphilis. But if small carious spots are detected at or near the openings of the various sinuses they are an almost certain indication of sinus suppuration. A carious patch on the anterior wall of the sphenoidal sinus indicates disease in that cavity. A perforation with rough edges in the outer wall of the inferior meatus, an occurrence I have twice met with, is probably distinctive of antral suppuration—provided syphilis and tubercle can be excluded. Digital examination is more reliable,

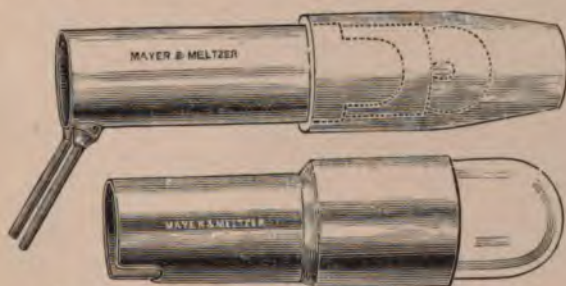


FIG. 105.—ELECTRIC LAMP FOR TRANSILLUMINATION. The upper figure represents the lamp enclosed in an opaque shield open only at the end, as used for the frontal sinus. The lower figure represents the metal shield with glass end, used when transilluminating the antrum.

but is only practicable under a general anaesthetic. When for some reason, such as for the removal of polypi, a general anaesthetic is given, an attempt should always be made to explore the nose, through both anterior and posterior nares, with the finger. I have thus been able to recognise a carious condition of the anterior surface of the sphenoid; the bone was so soft that it easily crumbled on pressure. This is a certain indication of suppuration in the sphenoidal sinus.

Transillumination. Another valuable means of diagnosis which must never be omitted in suspected cases of antral suppuration is transillumination. Heryng, in 1889, first placed this method upon a sound basis. To examine **the antrum** the patient is taken into a dark room, a small but powerful electric lamp (see Fig. 105) is placed in his mouth, and he is directed to close the lips tightly. Of course any artificial tooth-plate must be removed. When the antra are normally translucent a bright crescent of light will be seen just above the infra-orbital margin (Heryng's sign), the pupils will appear bright (Vohsen's sign), and the patient will experience a subjective sensation of light—Brown Kelly's sign (see Fig. 106). These three phenomena indicate that the light has actually traversed the roof of the antrum; they are unaffected by disease in the nose. In addition, I usually place my fingers on the

patient's lower eyelids, drawing them gently forwards and downwards, and thus expose a bright band of light immediately under the eyeball; this makes the test a little more distinctive and delicate. When the antral cavities are opaque there are no bright bands above the infra-orbital margins, the pupils are not illuminated, and the patient does not perceive the light. Transillumination naturally yields more definite and reliable results if suppuration exist in one antrum only, so that the translucency of the two sides



FIG. 106.—TRANSILLUMINATION OF THE ANTRUM. The left cheek is clear, the right is dark.

can be compared. It is of great advantage to vary the intensity of the illumination during the examination, as slight differences between the two sides are often best brought out with a weaker light, whilst occasionally a strong light is required to penetrate the bony walls.

Results. The method is of considerable value as confirmatory evidence of antral suppuration, but it may give indefinite or unreliable results. Wilkins in 100 normal cases found that the cheeks illuminated brightly in 54, in 37 not definitely, whilst in 9 they were dark. The pupils appeared bright in 74 cases, and there was a subjective sensation of light in 97. Very rarely the results were different on the two sides. Brown Kelly gives the following table of the comparative frequency of the three signs in 100 persons with presumably normal antra.

	Crescent.	Pupil.	Subjective Light.
Present on both sides equally, - - - - -	62	53	60
„ „ but unequally, - - - - -	17	17	21
„ „ one side only, - - - - -	8	7	9
Absent on both sides, - - - - -	13	23	10

Again, in unilateral empyema of the antrum there may be no marked difference in the translucency of the two sides. Wilkins in 39 cases found no difference in the cheek in 5, and no great difference in 3; in 36 the pupil was dark and there was no subjective sensation of light on the affected side; in 3 both sides were practically alike. Logan Turner in 51 cases found that a marked contrast existed between the result obtained on the diseased and that on the healthy side in 45, and no contrast in six. It has been stated that when only a little pus is present in an antrum the cheek on the affected side may be well lighted. I have met with several cases in which the cheek appeared bright on transillumination and in which careful examination failed to show any difference on the two sides; yet on puncturing the antra much thick pus has been found on one side only. It is doubtful if the opacity usually met with depends upon the actual presence of the pus so much as upon inflammatory thickening of the walls of the cavity, for, on washing out the antrum, the opacity on transillumination remains, and may even continue for some long time after the cavity has ceased to contain pus.

The antrum is transilluminated best in spare people with large thin-walled cavities. These conditions are most often met with in persons with a broad type of face, wide nasal fossae, and flat palates. The conditions which prevent the light passing through freely may be anatomical or pathological. Amongst the anatomical peculiarities are: Small size of the cavities such as is especially met with in persons with high narrow palates and deep canine fossae. The face may be congenitally asymmetrical, one antrum may be considerably smaller than the other, and consequently much more opaque on transillumination. Stout men with thick bones also transilluminate badly. Amongst the pathological conditions hindering transillumination may be mentioned collections of pus or blood, inflammatory thickening of the walls of the cavity from dental causes, and solid tumours of the antrum. Cystic disease or polypus of the antrum allows the light to pass more freely than normal, especially if the cavity is dilated.

Thus transillumination of the antrum even in a unilateral case of nasal suppuration offers no certain means of diagnosis. One antrum may be dark and yet contain no pus, whilst a suppurating antrum may be comparatively translucent. Comparing the various signs, the most generally reliable is the darkening of the crescent below the eyeball, especially if combined with one of the ocular symptoms (Brown Kelly). The subjective sensation of light is the best of all, provided the patient is intelligent. In one condition only does transillumination yield certain results. If the patient be under treatment for nasal suppuration, and an antrum previously ascertained to be

translucent becomes opaque, it is certain to contain pus. In spite of this want of absolute certainty the method is a most valuable one, and should never be omitted when excessive nasal discharge is present. Many cases of post-nasal catarrh are met with in which transillumination carried out as a routine measure will immediately direct the attention to the true source of the trouble.

Transillumination has also been applied to the examination of the **frontal sinus**, the lamp concealed in a suitable shield being applied close under the supra-orbital margin. This method is of no practical value. Normal frontal sinuses vary so much in size, in position, and in the thickness of their walls, that one is frequently more opaque than the other. The sign has not even a negative value, for a frontal sinus which secretes pus may appear translucent, especially if large. Enthusiasts for this method have even endeavoured to light up the ethmoidal cells by inserting a lamp into the nose; but it need hardly be said that this is useless.

By examining a case on the above lines, and carefully estimating the value of the various symptoms and signs, it is possible to arrive at a probable diagnosis of the cavity or cavities involved. It must always be remembered that more than one cavity may be simultaneously affected, and therefore if the symptoms continue after one suppurating sinus has been found and treated, other cavities must be explored. In the most doubtful cases it is usually possible to decide at least whether the anterior set of cavities, *i.e.* the maxillary antrum, the frontal sinus, and anterior ethmoidal cells, are involved, or whether the pus comes from the posterior set, *i.e.*, the sphenoidal sinus and posterior ethmoidal cells.

Still, it must be distinctly borne in mind that the symptoms and signs so far discussed are at most presumptive or probable indications; the only certain sign is the actual demonstration of pus in the cavity. The order in which the various cavities should be explored, and the ways by which exploration should be effected, depend upon varying circumstances.

Exploration of Sinuses. If there are numerous polypi present in the nose, my rule is to commence the treatment, and at the same time to clear up the diagnosis, by a radical operation on the polypi. I think it is best to give a general anaesthetic, to explore the nose with the finger, and then to remove the polypi and curette the ethmoid in the way above described (see p. 195). By this means the ethmoidal cells are thoroughly opened up, and, at the same time, the approaches to the other sinuses are cleared. Before concluding this operation, it is convenient to puncture and wash out the antrum in one of the ways about to be described, so as definitely to ascertain the presence or absence of suppuration in it. If when complete healing has occurred a purulent discharge still continues, its source can easily be recognised. If the pus appears high up in the front of the nose, it must come from the frontal sinus; if it appears at the back of the nose, it must come from the sphenoidal sinus. Of course a little pus might be derived from an ethmoidal cell which had been

imperfectly opened; this source would probably be recognised without much difficulty.

Puncture of Antrum. When there are no polypi to necessitate a radical operation on the ethmoid, when the signs already enumerated point to suppuration in the antrum, or when the anterior set of cavities appear to be involved but there is no definite evidence pointing to any one cavity in particular, it is best to begin by exploring the antrum. The method to be chosen depends upon various circumstances. When there are painful or tender carious teeth or stumps in the alveolar margin, especially if the 1st or 2nd molar or either of the bicuspidis is affected, it is best to extract the affected tooth, and to perforate the antrum through its socket. A small opening should be made with an antrum drill, and the cavity washed out with a mild antiseptic solution. The nose having been previously cleansed, if pus appears in the washing, it must come from the antrum. By this method a possible cause of the trouble is removed, and the opening made may be retained for treatment. If there is no reason to suspect that the teeth are the source of the disease, it is better to perforate the antrum from the inferior meatus with a fine trochar and cannula such as that of Lichtwitz. The cannula having been inserted, the cavity is washed out with the above-mentioned precautions. This is to be recommended as the routine method for exploring the antrum; perforation from the alveolar margin is only to be preferred when tender carious teeth exist, and are a probable cause of the suppuration. The methods of performing these little operations will be described in detail when speaking of the treatment of antral disease (see Chap. XIX.). A word of caution appears necessary. One puncture is sufficient; if the cavity is suppurating pus will always be present. Grünwald advises repeated puncture if a negative result is obtained, and says pus may not be found until even the third or fourth exploration. It seems quite possible that puncture is not altogether free from risk, and that repeated punctures may cause suppuration, and thus account for the presence of pus in cavities previously ascertained to be healthy (Krebs).

The antrum may also be explored through the canine fossa. This operation is a little more difficult as the bone is thick, the opening is inconveniently placed for subsequent treatment, and ill effects such as swelling of the cheek or an abscess from infection of the soft parts may occur. Exploration by catheterization of the maxillary ostium is very difficult, and uncertain.

It will be convenient briefly to summarise the various diagnostic signs and symptoms of suppuration in the antrum, dividing them after the plan of Lermoyez into presumptive, probable, and certain signs.

Presumptive. Unilateral, purulent, intermittent nasal discharge—pain or headache relieved by a flow of pus—large amount of discharge—marked subjective foetor—pain and tenderness in the infra-orbital region or over the malar bone—pain and tenderness over the side of the nose and supra-

orbital region—pus coming from the middle meatus of the nose—polypi, hypertrophies or oedema of the nasal mucous membrane, limited to the middle meatus.

Probable. After cleansing the nose, pus re-appears in the middle meatus on bending the head forward or to the opposite side. Caries near the maxillary ostium or in the outer wall of the inferior meatus—the presence of carious, tender teeth in the corresponding alveolar margin, or the history of severe tooth-ache or dental abscess at the commencement of the affection—marked opacity on transillumination.

Certain. Pus obtained by irrigating or aspirating the antrum after puncture through the alveolus, the inferior or the middle meatus of the nose.

Anterior Ethmoidal Cells. When suppuration in the antrum has been excluded, or when, after washing out that cavity, pus still continues to come down into the middle meatus, the anterior ethmoidal region should be explored. As a preliminary the anterior half of the middle turbinate should be removed. The middle meatus is then carefully inspected and probed to ascertain the existence of any oedematous mucous membrane or carious area of bone. It may be possible to pass a suitable bent probe or cannula into the opening of an ethmoidal cell and to obtain pus from it. This cavity should then be opened in the way about to be described (see Chap. XX.). So long as pus continues to come other cavities should be explored and opened up in a similar way. Should there be much discharge, or other sign of extensive disease in the anterior ethmoidal region, it is a good plan to put the patient under a general anaesthetic—nitrous-oxide may be sufficient—and to curette the region with a ring knife. By carefully exploring and opening up cell after cell in this way, the existence of suppuration in the anterior ethmoidal region may be confirmed or eliminated. The signs of suppuration in this region may be tabulated as follows:

Presumptive. Continuous discharge of pus in the middle meatus associated with supra-orbital pain and tenderness, headaches, asthenopia, neurasthenia, and general depression.

Probable. The presence of numerous polypi or granulations with pus exuding between them—the presence of bare carious bone in the ethmoidal region as ascertained by digital examination or by probing—probing causes bleeding, and elicits great tenderness—pain on pressure over the lachrymal bones—bulging of inner wall of orbit or lateral expansion of nose—elimination of antral suppuration.

Certain. The finding of pus on opening the ethmoidal cells—cessation of suppuration after opening up the ethmoid.

Frontal Sinus. The existence of suppuration in the frontal sinus can only be definitely ascertained by an external opening into the sinus and inspection of its interior. Before proceeding to this step the greatest care must be taken to render the diagnosis as certain as possible. The chief step consists in excluding antrum and ethmoidal cell suppuration as above described. If the antrum and the anterior ethmoidal cells have been

opened, and pus in any considerable quantity still continues to come from the upper part of the middle meatus, it almost certainly comes from the frontal sinus. Under these circumstances an endeavour may be made to pass a probe into the sinus so as to ascertain the direction of the infundibulum. If this manœuvre is successful, a suitably curved cannula should be inserted, and the sinus washed out. If much pus be obtained the diagnosis is tolerably sure, although it is by no means so certain as some surgeons consider. When a probable diagnosis has been made the sinus may be opened externally if the severity of the symptoms warrant it.

The signs of suppuration in the frontal sinus are:

Presumptive. Continuous and usually profuse discharge in the middle meatus—polypi limited to middle meatus—supra-orbital pain and tenderness—tenderness on pressure over inner part of inferior wall of sinus—opacity on transillumination.

Probable. Pus constantly returns after cleansing nose but none is obtained on lowering head—elimination of antrum and of ethmoidal cell suppuration—finding of pus by catheterization of the sinus through the nose.

Certain. External opening and inspection.

Sphenoidal Sinus and Posterior Ethmoidal Cells. When there is a purulent discharge from the superior meatus of the nose either into the post-nasal space or forward into the olfactory cleft, the sphenoidal sinus should be explored. In atrophic rhinitis, if the middle turbinate be atrophied, it may be possible, especially with the aid of cocaine and suprarenal extract, to see the sphenoidal ostium. When this is not possible the middle turbinate should be removed and the opening of the sinus thus brought into view. When this has been done pus may be seen coming from the opening, or a probe may be passed into it, the cavity explored and then washed out with a suitably bent cannula. If pus be found the cavity should be opened (see Chap. XXII.).

If pus still continue to come from the posterior and upper part of the nose after the sphenoidal sinus has been found healthy, or has been opened and washed out, the posterior ethmoidal region must be explored. It is necessary to remove the whole of the middle turbinate, and then the cells should be opened up one by one in the way which will shortly be described (see Chap. XX.). The signs and symptoms of suppuration in these cavities may be grouped as follows:

Sphenoidal Sinus. Presumptive. Frequent presence of pus in the olfactory cleft, in the post-nasal space, on the anterior surface of the sphenoid, or on the upper surface of the superior or middle turbinates as ascertained by posterior rhinoscopy—pain referred to the back of the head or neck, or deep in the nose—polypi in the superior meatus—blindness, hemianopia, optic neuritis unilateral or bilateral.

Probable. Caries near the sphenoidal ostium—tenderness on probing—oedema of the anterior wall of the sinus.

Certain. Pus oozing from the orifice of the sinus—pus obtained by irrigation or opening of the cavity.

Posterior Ethmoidal Cells. Presumptive. The same as for the sphenoidal sinus.

Probable. Polypus or caries of the posterior end of the middle turbinate—elimination of the sphenoidal sinus.

Certain. Opening of the cells and the result of treatment.

MANIFEST EMPYEMA.

When the walls of a sinus are bulging: when there are redness, oedema, and tenderness of the adjacent soft parts: when there is a discharging fistula or an external abscess communicating with the cavity, the diagnosis is generally obvious and needs little elucidation. It is sufficient to mention the following points:

On pressure over the swelling pus may be forced out into the nose, or if a fistula exist, or an abscess have been opened, it may be possible to pass a probe or finger through the wound into the sinus. Also, on syringing lotion into the wound the fluid may pass into the nose. The presence of any of these signs renders the diagnosis absolutely certain. The following conditions may more or less resemble a manifest empyema.

Malignant Disease of a sinus may cause bulging of its walls, and may also be associated with a purulent nasal discharge. For example, malignant disease of the outer wall of the nose, or of the antrum, may be associated with antral suppuration. The great point is to recognise that malignant disease is present. This is not always easy, but it should be suspected if there be great pain in the face, persistent oedema or swelling of the cheek or lower eyelid, signs of distension of the cavity in an unusual direction, or lachrymal obstruction, especially if these symptoms increase or persist after the antrum has been opened. Sometimes the existence of malignant disease can only be recognised on operation. Thus, after the antrum has been drilled, it may be found difficult to syringe through it, or when a large opening has been made, a mass of malignant growth may be felt with the finger.

A **mucocoele** may also cause distension of a sinus. In uncomplicated cases no pus is found in the nose, the walls of the sinus bulge in the directions of least resistance, there is no tenderness and no oedema of the sinus walls. If the antrum be affected, it will still remain translucent. Distension of the walls of a sinus without acute signs of retention of pus, local or general, indicates a mucocoele, and is never found in suppurative conditions.

An **orbital abscess or cellulitis** may arise from perforation of a suppurating frontal sinus, ethmoidal cell, or antrum. Usually there is some fleeting oedema, tenderness or swelling in the orbit, and then suddenly acute symptoms set in, accompanied by headache, fever, and general

disturbances. There is great pain in the orbit, with displacement or fixation of the eyeball, oedema and redness of the eyelids. If these symptoms are associated with purulent discharge from the nose, nasal polypi, or hypertrophies, the existence of sinus suppuration may be presumed. In one out of five cases described by Hajek the empyema was closed, that is, no pus was seen in the nose. Sometimes the diagnosis may be rendered certain by clearing away the polypi and oedematous mucous membrane and then opening a cavity containing pus. In this way, not only may the diagnosis be made, but the abscess may be cured. In other cases exploration by the probe or finger after opening the abscess externally, will clear up the diagnosis. An abscess bursting through from the antrum usually produces a swelling on the lower or inner wall of the orbit: from the ethmoidal cells on the inner side of the orbit, and from the frontal sinus in the upper or inner part. If a fistula has formed in connection with the frontal sinus, it is almost always found in the centre of the upper lid.

Periostitis of the Upper Jaw. A periosteal abscess or fistula in connection with carious teeth, or following tooth extraction or other cause, may simulate antral suppuration. The absence of pus in the nose and of any communication between the antrum and the abscess, as determined by probing or syringing, will enable the diagnosis to be made.

Acute osteomyelitis of the upper jaw is a curious affection usually met with in children, and has been frequently described as antral suppuration at an unusually early age.¹ As late as the sixth year, the antrum is a very small cavity, and no instance of suppuration in it before this period has come under my notice, or has ever been truly verified. The cases of osteomyelitis are nearly all similar. An abscess forms, and bursts or is opened just inside the cheek above the canine or one of the adjacent teeth. Usually the abscess also points at the inner angle of the orbit, and the two openings communicate, as may be shown by syringing or by probing. The probe may pass beneath the periosteum or into the bone, and much bare carious bone is felt. Avellis was the first to point out the true nature of these cases.

A **dental cyst**, especially if suppurating, may simulate antral suppuration. Enlargement of the alveolus of the upper jaw, or a swelling in the hard palate, should at once point to a dental cyst. Hajek states that he has never seen the upper jaw distended in antral suppuration: it is undoubtedly rare, and when it does occur the cavity bulges into the canine fossa, into the nose, or into the orbit, and never into the hard palate or alveolar process. The bulging of the superior wall is a most important sign, for it definitely indicates disease of the antrum, and can never occur as

¹ Thus Rudaux (*Annales des Mal. de l'Oreille*, etc., 1895, xxi. pt. 2, p. 239), reports a case in an infant of 3 weeks; D'Arcy Power (*Brit. Med. Journ.*, 1897, ii. p. 808), a case at 8 weeks, Roure (*Archiv. internat. de Laryngol.*, 1898, xi. p. 137), a case at 10 days of age; Mayer (*Medical Record*, 1901, August 10th), one at 2½ years, etc.

the result of a dental cyst. The outer wall of a dental cyst may perforate, and give rise to an abscess in the cheek, or an abscess or sinus may form in the hard palate or alveolar margin. On probing or syringing it will be demonstrated that there is no communication between this cavity and the antrum or nose. Of course it is possible that a dental cyst may burst into the antrum, one instance of this extremely rare occurrence having been privately reported to me.

The following works may be consulted :

- KREBS. Archiv für Laryngol., 1898, iv. p. 224.
 RETHI. Wien. klin. Rundschau, 1899, Oct. 22nd.
 HAJEK. Archiv für Laryngol., 1904, xvi. p. 105.
 MCKEOWN. Lancet, 1902, ii. p. 290.

Transillumination.

- HERYNG. Berlin. klin. Woch., 1889, xxvi. pp. 774, 798.
 VOHSEN. Berlin. klin. Woch., 1890, xxvii. p. 274.
 BROWN KELLY. Glasgow Med. Journal, 1892, xxxvii. p. 100.
 BROWN KELLY. Brit. Med. Journ., 1905, i. p. 650.
 ROBERTSON. Journal of Laryngol., 1892, p. 62.
 ZIEM. Monatschr. für Ohrenheilk., 1893, xxvii. pp. 231, 261.
 BURGER. Monatschr. für Ohrenheilk., 1893, xxvii. p. 323.

Osteomyelitis of Upper Jaw.

- AVELLIS. Münch. med. Woch., 1898, xlv. p. 1433.
 SCHMIEGELOW. Archiv für Laryngol., 1896, v. p. 115.
 LICHTWITZ. Archiv für Laryngol., 1898, vii. p. 439.

CHAPTER XIX.

TREATMENT OF CHRONIC SUPPURATION OF THE ACCESSORY SINUSES.

INTRODUCTION.

IN chronic suppuration of the accessory cavities of the nose it must at once be admitted that there is no possibility of a spontaneous cure, and that in every case surgical interference will be required. The objects to be aimed at in attempting the cure of a suppurating sinus may be enumerated as follows:

- (1) The treatment of any intranasal disease, and especially the removal of any cause of nasal obstruction such as polypus, so as to make a free approach to the ostium of the affected cavity.
- (2) The removal of the retained discharge with or without opening the sinus.
- (3) The removal of the cause if still present.
- (4) The removal of all pathological conditions which are set up by the suppuration and tend to maintain it, such as granulations, polypi, carious or necrosed bone. And
- (5) when the above treatment fails to effect a cure, the adoption of means to prevent re-accumulation of the pus either by providing permanent free drainage, or by obliterating the cavity.

Although the treatment is essentially surgical, every means, medicinal and otherwise, must be adopted to maintain or to improve the general health. A change of air, especially to a dry, bracing place, or to the seaside may be of the greatest benefit. General treatment may often render completely successful a smaller operation than would otherwise be necessary, or effect a cure when operative means alone have failed.

Multiple Sinusitis. A point that must never be overlooked in the general management of these cases is that many sinuses are often simultaneously involved, and that a multiple sinusitis must be treated as a whole rather than as a series of isolated unconnected affections. This mistake is far too often made, possibly owing to the fact that the affections of each individual cavity are separately described in most books as if they were absolutely independent of each other; whereas, in reality, the various

sinuses are closely associated, and the cure of one often depends upon the simultaneous cure of the others. Even the diagnosis depends to a large extent upon the result of treatment. When several sinuses are suppurating no absolute rule can be laid down as to the order in which they should be treated, but some general directions may be given for guidance.

Order of Opening Sinuses. As already shown, it is usually possible to determine with some degree of accuracy which set of sinuses is affected; namely, whether the pus comes from the anterior set, that is the antrum, the anterior ethmoidal cells, and the frontal sinuses; or whether the posterior set, the posterior ethmoidal cells, and the sphenoidal sinus, are affected. If the anterior set of sinuses are involved and there is extensive polypoid degeneration or caries in the ethmoidal region, the ethmoidal cells should be first attacked, the polypi being removed and the ethmoidal region thoroughly curetted. Subsequently, if pus still continues to come from the nose, the antrum should be treated, and finally the frontal sinus. When, on the other hand, there is no indication as to which sinus is affected the antrum should be first explored and treated if found diseased; then the anterior end of the middle turbinate should be removed and any suspected anterior ethmoidal cells opened up; finally, the frontal sinus should be attacked. When the posterior set of cavities are involved, if, as occasionally happens in atrophic rhinitis, a view can be obtained of the ostium of the sphenoidal sinus, this sinus may be treated first, but in the large majority of cases it is necessary to commence the treatment by removing the posterior half or the whole of the middle turbinate. By this means the openings of the posterior ethmoidal cells and the ostium of the sphenoidal sinus are exposed to view: a complete diagnosis can then be made and further treatment carried out as required. In the rarer cases when the diagnosis cannot be made between affections of the anterior and posterior set of sinuses—and this, in my experience, has only occurred when numerous polypi are present, or when all the cavities are simultaneously involved—the first indication for treatment is the removal of the nasal polypi by the radical method already described (see p. 194). When this has been done a probable diagnosis can usually be made, but if not, the anterior set of sinuses should be first attacked *seriatim*, and subsequently the posterior.

To give an example, in one case recently under my care, the left nasal fossa was full of polypi and granulations, from the midst of which much pus exuded. The polypi were removed with the snare. Subsequently, as extensive ethmoidal disease was disclosed, this region was thoroughly curetted, and the greater part of the ethmoidal cells opened. Whilst the patient was under the anaesthetic a small opening was made into the antrum through the alveolar border. On washing out the antrum it was found to contain pus; a plug was therefore inserted in the opening and regular irrigations instituted. When healing of the ethmoidal region had occurred pus in considerable quantity still continued to come down into the anterior part of

the nose. A probe could be passed up into what appeared to be the frontal sinus, and its withdrawal was followed by a discharge of pus, this sinus therefore was opened externally, and, being found diseased, was obliterated. Nasal discharge still continuing, the sphenoidal sinus was explored and found to contain pus. After being irrigated for a few days without effect, the anterior wall of the sinus was removed. A general anaesthetic being given for this, a radical operation was performed at the same time upon the antrum, which still continued to secrete a little pus. Thus ultimately every sinus on the left side was opened, and drained or obliterated. The case is a typical and by no means rare instance; it well illustrates the order in which I think multiple sinus suppuration should be treated. The radical operation on the antrum was delayed to the last, as suppuration in this cavity often yields to simple treatment when the disease of the frontal and ethmoidal sinuses has been cured. The point on which too much stress cannot be laid is that it is necessary to open the cavities one by one until every source of suppuration has been found and removed. The treatment of each sinus presents somewhat different problems, and therefore must be considered separately.

TREATMENT OF CHRONIC SUPPURATION IN THE MAXILLARY ANTRUM.

When no External Complications are Present. In the first place suppuration in the antrum should be treated by irrigation, either through its natural opening or through a small puncture. These methods are very simple and comparatively harmless. They should be invariably adopted in the first instance, except in the rare cases in which severe symptoms are present pointing to caries or necrosis of the walls of the sinus, or in which there is distension of the cavity, or an external abscess or fistula communicating with it, or when it is probable that a foreign body is present; in these circumstances a more radical proceeding is always necessary (see page 322).

The chief methods practised are as follows: (1) Puncture and irrigation through the alveolus. (2) Puncture and irrigation through the inferior meatus. (3) Puncture and irrigation through the canine fossa. (4) Irrigation through the natural ostium. These methods are all similar in principle, for even when an artificial opening is made it is too small for drainage, and really only provides an easy means of cleansing the cavity at intervals, the pus re-accumulating between each washing. Frequently, however, this intermittent cleansing is sufficient to effect a cure. If the ostium of the sinus be patent, and the mucous membrane lining the cavity, and especially its ciliated epithelium, be not irretrievably damaged, the antrum may return to its original healthy condition.

The particular method to be adopted depends on various circumstances.

Alveolar Puncture. If carious teeth be present in proximity to the floor of the antrum, they should be extracted and the cavity opened through a tooth socket. The operation can be easily performed under gas: a small hand drill, or a burr driven by an electric motor, may be used. The first molar is the site of election as its roots are separated by a very thin plate of bone from the floor of the antrum, and sometimes even protrude into the cavity. Also at this point the antrum is tapped at its lowest part. Should the first molar be healthy it is quite easy to reach the antrum through



FIG. 107.—DRILL FOR PERFORATING THE ANTRUM THROUGH THE ALVEOLAR BORDER.

the sockets of the second molar or of the second bicuspid. It is rather more difficult to perforate the socket of the first bicuspid, as the bone in this region is thicker, and the anterior portion of the antrum is so narrow that great care is required to keep the drill in the right direction. The objection to perforating the antrum through the socket of the second molar is that the opening is situated so far back in the mouth that it is difficult for the patient to find it, and to conduct the after treatment. The same objection applies still more forcibly to perforation of the sockets of the third molar. The same method may be practised when any of the above-mentioned teeth are absent, leaving vacant spaces. When the teeth have been long removed a small incision should be made through the gum with a knife, and great care must be taken to prevent the drill from slipping off the alveolar border, which often has become very dense and narrow.

Having made the opening, the nozzle of an antrum syringe is inserted, and the cavity washed out with a warm solution of boracic acid or other non-irritating antiseptic, the patient's head being bent well forward so that the lotion may flow out by the nose. After cleansing the cavity a small tube



FIG. 108.—ELLIS'S SPIRAL SILVER WIRE TUBES FOR ANTRUM.

or plug, preferably of silver or gold, is inserted, and may be fixed by a dentist to a neighbouring tooth. Care must be taken that the tube cannot slip up into the antrum as frequently happens with ill-devised appliances. The opening made may be three to five millimetres in diameter. Personally I prefer the smaller opening; although the larger one is frequently recommended, it is more unpleasant for the patient in that it may allow particles of food to enter the sinus and pus to escape into the mouth. An opening

in the alveolus is never suitable for inspection or curettement, or even for drainage of the antrum, it is only of service for irrigation.

After Treatment. The cavity should be irrigated twice daily, or more often if the discharge is profuse, the tube being removed on each occasion, boiled, and replaced. Any non-irritating antiseptic lotion may be used—weak boracic or ordinary salt solution are as good as anything. As the discharge gradually lessens irrigation may be carried out once daily, and if then no discharge is seen, may be omitted for a few days. If after a week's interval the antrum is washed out and no discharge is found, the tube may be removed and the hole allowed to close. Should simple irrigation succeed in reducing the amount of the discharge but fail to effect a cure, other lotions may be tried. Of these a solution of hydrogen peroxide, 10-20 volumes, is one of the most reliable. It should be slowly injected and allowed to remain in the cavity for a few seconds, then washed away with boracic solution. It often causes smarting, and may give rise to increased discharge for a few days. The application may be repeated at intervals of not less than a week if it appears to do good. Another lotion that may be tried is a 2-10 per cent. solution of cupric sulphate. Hajek recommends that the sinus be irrigated with this solution every second day for a week or ten days, and that then an interval be allowed to elapse to judge of the effect. A two per cent. solution should be used at first, and the strength gradually increased as tolerance is established. Should this fail a solution of formalin may be tried in a similar way; or the dry treatment as recommended by Krause and Friedländer may be adopted. Having washed out the discharge, the cavity is aspirated to draw off any lotion remaining in it, and then a little dry powder, such as boracic acid or iodoform, or a mixture of both, is blown into it. By these means a cure may occasionally, though rarely, be obtained after irrigation alone has failed.

The **advantages** of the method of alveolar puncture are that after a day or two the irrigation may be safely entrusted to the patient, who rarely experiences any pain or trouble in carrying it out, and thus the treatment may be easily continued for a long period; that the extraction of the carious teeth is always advisable, as they may be a source of irritation to the antrum even if they were not the actual cause of the trouble; that the antrum is opened at its lowest point; that the operation is easy, especially if the puncture be made through the socket of the first molar or second bicuspid; that when the operation is performed with due care no ill effects will follow.

The **dangers and difficulties** of the operation are:—(1) That if care be not taken to keep the drill in the right direction the floor of the antrum may be missed, and the drill may perforate the hard palate or the floor of the nose if directed too far inwards, or may pass into the canine fossa if directed too far outwards. This danger is especially liable to occur when the alveolar border is narrow, when it is necessary to penetrate some depth before the floor of the antrum is reached, when

the operation is performed through the socket of the first bicuspid tooth, or when the teeth have been removed some time previously. If due care be taken, and the alveolar border grasped with the finger and thumb of the left hand whilst the drill is used, there should be no difficulty in avoiding these accidents. (2) That the floor of the orbit may be punctured. If too much force be used, and the drill suddenly slip into the antrum, it may traverse the cavity and injure the floor of the orbit. This accident may be prevented by having a movable ring guard on the drill, as shown in figure 167, or by using the tip of the finger as a check. (3) That haemorrhage may follow. Two cases at least are on record,¹ and another occurred in my own practice, in which bleeding continued for hours after the operation, and produced great exhaustion. Whether the bleeding was due to the extraction of the tooth or to the puncture of the antrum it is impossible to say. In my own case there was no general disease, such as haemophilia, to account for the haemorrhage.

The method has the **disadvantages** that a communication is established between the antrum and the mouth, which provides a possible entrance for sepsis or for particles of food, and that the plug may interfere with mastication. These objections can be partly overcome by fitting a suitable tube or plug, and the danger of sepsis is probably more imaginary than real. Further, the patient may experience a nasty taste from pus entering the mouth, but if the pus be allowed to escape into the nose it gives rise to an unpleasant smell, which is perhaps as bad. Lastly, in some rare cases it is impossible to perform this operation owing to anatomical peculiarities. As already shown, the antrum may be limited to a small cavity situated high up under the orbit, and may not extend into the alveolar process at all. The presence of this deformity may be recognised by examination of the upper jaw, when it will be found that there is a deep depression in the canine fossa, that the palate is high and narrow, and the alveolar process extremely slender, as felt between the fingers. Under these circumstances the operation should not be attempted, for, if it be, the drill will almost certainly enter the canine fossa, or perforate the hard palate. When these conditions are met with it is better to perforate the antrum from the middle meatus, or from the canine fossa.²

Results. The published accounts of results are very conflicting. Thus, Alsen reports 17 cures in 28 very chronic cases, whilst Tilley reports only 5 cures in 27, although in a previous report he claimed to have obtained 16 out of 34. Chiari reports 27 cures in 58 cases. Prolonged experience has certainly not justified the claims originally put forward for this method, and recently even the possibility of a cure in chronic cases has been questioned. An impartial consideration seems, however, to justify the following conclusions: 1. In dental cases, recent or chronic, a very large

¹ Scheppegrell, *Journ. of Laryngol.*, 1895, ix. p. 621.

² Lack, *Journ. of Laryngol.*, 1900, xv. p. 199.

majority are cured. 2. In recent cases of nasal origin the majority are cured. 3. Taking all cases together, about 50 per cent. are cured, and every case is relieved. 4. The cure depends greatly upon the care with which the patient conducts the after treatment.

Puncture through the Inferior Meatus of the nose is thus performed. A pledget of wool, soaked in a solution of cocaine and suprarenal extract, is packed under the inferior turbinate, and pressed well against the outer wall of the inferior meatus. When the parts are anaesthetized a small trochar and cannula, such as Lichtwitz's or Cresswell Baber's, is passed into the inferior meatus, the point of the trochar being concealed within the cannula. The instrument is passed about half an inch behind the anterior extremity of the inferior turbinate and then directed strongly outwards and upwards so as to bring it in contact with the antromental septum at its thinnest part. In doing this the flexible cartilaginous portion of the nasal septum is pressed over to the opposite side. The trochar is now extruded from the cannula, and the instrument pushed forcibly onwards with a slight rotary movement in an outward, backward, and upward direction into the antrum. The giving way of the bony wall



FIG. 109.—CRESSWELL BABER'S TROCHAR AND CANNULA FOR ANTRUM.

and the sudden entrance of the trochar into the cavity can be easily recognised. The trochar is then withdrawn and the cavity washed out through the cannula with a mild antiseptic, such as boracic acid solution. The operation is easy if care be taken to make the puncture above the thick ridge of bone that forms the junction of the external wall and floor of the nose. It may be difficult to perforate, however, if the outer wall of the nose curve strongly outwards, if the inferior turbinate be very large, or if the septum be much deflected. These conditions may even make the operation impossible, and render it necessary to adopt some other method, unless the anterior end of the turbinate or obstructing portion of the septum is first removed.

The **dangers and difficulties** that may be met with are as follows:

If the floor of the antrum be above the level of the floor of the nose the trochar may be pushed into the body of the upper jaw and even forced through it into the tissues of the cheek. This may be avoided by the caution already given to direct the point of the trochar upwards as far as possible. In the rare cases of extreme ill-development of the antrum already described (see page 316), the operation should never be attempted. When puncture through the inferior meatus fails through absence of the lower part of the antrum—as happened twice in 300 cases recorded by Hajek—puncture through the middle meatus will usually succeed.

If the cavity be narrow, or if too much force be used, the trochar

may traverse the antrum and penetrate its external wall. The occurrence of this accident may be recognised by exploring the canine fossa with the finger, or by the results of irrigation. The fluid will not readily flow through the cannula, and if the trochar has been pushed quite through the external wall into the canine fossa, a forcible attempt to wash out the sinus will drive the fluid into the soft tissues of the cheek. If therefore on attempting irrigation the fluid does not enter freely, the cannula should be slightly withdrawn and another attempt should be made, but force must be carefully avoided. If this fails it is better to withdraw the cannula entirely to see if it is blocked with a piece of mucous membrane or bone, as occasionally happens, and then to reinsert it with great care. If fluid enters the cheek there is immediate sharp pain and swelling, and cellulitis or acute abscess may follow. This accident may usually be avoided with care. In doubtful cases, when from the narrowness of the upper jaw it seems probable that the antrum is small, the trochar should be directed rather behind, than in front of, the centre of the inferior meatus. When there is marked deformity of the upper jaw the trochar should be inserted through the middle meatus, just above the inferior turbinate.

The **advantages** of this method are that it does not entail the sacrifice of a healthy tooth when no carious teeth or vacant spaces are present; that it only requires cocaine anaesthesia; and that it does not establish a communication between the antrum and the mouth. Its great **disadvantage** is that the opening cannot be maintained, and therefore the operation has to be repeated daily, or as often as is considered necessary, by the surgeon himself, rendering prolonged treatment impossible.

Results. Lermoyez and others who have extensively employed this method state that the results obtained by it are better than those obtained by alveolar puncture. My own experience is too limited to form any definite opinion. It is certainly often successful in acute, and occasionally even in chronic cases of nasal origin. Thus in a patient with suppuration of the antrum of five years' standing, the result of influenza, puncture with a Lichtwitz's trochar was performed every day for five successive days, and the antrum irrigated with boracic acid lotion. Much foetid pus was found on the first occasion, but after the fifth washing the patient was cured. The cure was confirmed by irrigation after an interval of five days. Lermoyez states that he has cured thirteen out of thirty really chronic cases.

Krause's Method. Puncture through the inferior meatus may also be performed with Krause's instruments, which consist of a large curved trochar and cannula with a conductor (see Fig. 110). The instrument is used in the same way as Lichtwitz's, but considerable force may be required to push it through into the antrum. The next time it is wished to introduce the cannula the blunt pointed conductor is used instead of the trochar, and an attempt is made to pass it through the opening previously made. In order to do this it is well to mark upon the cannula

the exact distance from the anterior edge of the septum at which the opening lies.

I have also performed on three occasions a modification of Krause's method, using a short curved trochar and cannula with a small flange. The cannula is left *in situ*, its proximal end lying just within the anterior nares. The patient can easily wash out the antrum two or three times



FIG. 110.—KRAUSE'S ANTRUM TROCHAR AND CANNULA, WITH CONDUCTOR.

daily through the cannula, and the method is therefore very suitable for hospital practice. In two chronic cases, in one of which much thick flaky deposit was present, a cure was obtained in four days. The cannula can be retained in position four to five days, and the opening made usually remains patent as many days longer, enabling a cannula to be inserted and the result confirmed.

The chief disadvantage of these methods may be overcome by making a **large opening through the inferior meatus** with a burr or electric drill. The operation may be carried out under nitrous oxide anaesthesia, but suprarenal extract should always be applied locally to render the parts anaemic. Some operators rely on cocaine anaesthesia alone, but the operation is painful. A small portion of the anterior end of the inferior turbinate is first removed. This allows access to the outer wall of the inferior meatus, and greatly facilitates the after treatment. A large burr is then pushed through the antro-meatal septum, and the wall broken down as thoroughly as possible. It should now be quite possible to irrigate the antrum freely, and an intelligent patient may be taught to do this for himself. The most



FIG. 111.—THE AUTHOR'S ANTRUM CANNULA.

convenient instrument for the purpose is a short curved silver cannula, to which, by means of a rubber tube, an ordinary glass or a Higginson syringe may be connected. The opening made tends to contract, but with daily irrigations it usually remains sufficiently patent to admit the cannula, and even when all treatment has been omitted after a week, I have found the opening remaining six months later. The irrigation should be carried out at first twice, then once daily, and gradually left off as described for alveolar puncture.

Results. I know of no statistics giving the results of a series of cases

treated by this method, but Dundas Grant,¹ Bond and others speak of it in very favourable terms. I have performed it as a routine practice during the past eighteen months, and have been surprised at the ease with which the after treatment can usually be conducted, especially when a portion of the inferior turbinate has been removed. The method allows irrigation to be practised without the inconvenience and risks of a communication with the mouth and of constantly wearing a tube. With an intelligent patient it is preferable to alveolar puncture in all cases not due to dental causes.

My own experience is mainly based on nineteen cases in private practice, which yielded sixteen cures and three partial successes. Of these three, two had previously undergone alveolar puncture. Many of the successes and all the failures were instances of very long-standing disease; six were complicated with polypi and ethmoidal suppuration, and were cases in which my own experience would not lead me to anticipate a cure from the alveolar method. My hospital experience, although yielding many good results, is not so favourable, owing to the difficulty of teaching the patient to conduct the after treatment with sufficient care and regularity.

The **operation through the canine fossa** may be performed under nitrous oxide or cocaine anaesthesia. The angle of the mouth is well retracted by an assistant, and a small incision is made at the junction of the mucous membrane of the cheek and gum, just above the bicuspid teeth. The bone is then perforated with a drill or burr, which may be driven by an electric motor. A small opening no more than 5 millimetres in diameter should be made. After the operation the antrum is washed out as above described, and the opening packed with a small strip of iodoform gauze. The gauze packing is removed for syringing, and renewed every day for three to five days, when it is replaced by a rubber plug or tube. This operation is apparently preferred by Hajek and Grünwald for the majority of cases.

The great **disadvantages** of the method are that a communication is made with the mouth, that the patient often experiences pain and difficulty in removing and re-inserting the tube; that the wearing of a tube in this position often gives rise to pain, swelling, and even ulceration of the cheek; that the discharge may infect the cheek and cause an acute abscess—which is apparently not very rare—or even erysipelas. Nearly always more or less painful swelling of the cheek is seen for a few days. The operation has the one advantage of being always practicable if an antrum exist, however small it may be.

Irrigation through the Natural Opening. The deep-lying situation of the maxillary ostium and the anatomical relationships of the hiatus semilunaris, which have already been described (see p. 6), show the great difficulty of this method. In the first place, any polypus or hypertrophy must be removed, and it is generally necessary to take away the anterior

¹ *Journ. of Laryngol.*, 1899, xiv. p. 70, and *Proc. Laryngol. Society of London*, 1895, ii. p. 67.

end of the middle turbinate. Should an accessory ostium be present, the manipulation is more easy. A blunt-pointed probe which can be easily bent in various directions is used to ascertain the curve by which the ostium can be most easily reached. A cannula is then bent into the same shape, inserted into the ostium and the sinus irrigated. According to Weil, this operation can always be practised, although in 20 per cent. of cases there is difficulty. Hajek succeeds in a large number of cases, believes it is possible to wash out the antrum thoroughly, and considers it is often a useful method of treatment. Hartmann, Störk, and Weil, among others, prefer this method. Personally, it seems to me to possess no advantages over puncture through the inferior meatus.

The method has many **disadvantages**. It requires to be carried out daily by the surgeon himself: it is more difficult and nearly as painful as perforating the antrum through the inferior meatus, especially when the anterior end of the middle turbinate has to be removed; and it is much less efficient in purifying the cavity. If thick secretion be present, or if the ostium be very small, it is quite impossible to wash away all the discharge; whereas, when the antrum is perforated from the inferior meatus, a stream of water is directed into the lower part of the cavity, and the ostium serves as a counter opening.

Conclusions. A consideration of the above methods shows that two of them are to be greatly preferred, and the following conclusions may be drawn: 1. That if the disease be obviously due to carious teeth, the teeth should be extracted and the alveolar operation performed. 2. That if, on the other hand, the teeth are healthy, puncture and irrigation through the inferior meatus of the nose should be adopted; and if the case be chronic, or a few irrigations prove ineffectual, the anterior end of the inferior turbinate should be removed, the opening enlarged, and the patient taught to carry out the treatment himself.

In exceptional cases only, the canine fossa route may be preferred, viz.: when all the teeth are sound and deflection of the septum or other form of nasal obstruction prevents puncture through the inferior meatus, and when a deep canine fossa with a high palatal arch renders the other methods of reaching the antrum uncertain.

Intra-nasal Treatment. In addition to these measures, efficient intra-nasal treatment must be adopted, the nose must be frequently cleansed, and any polypi or other hypertrophy in the middle meatus must be removed so as to clear a free passage to the ostium of the sinus. It must also be noted that, if any pus re-appears in the nose immediately after washing out the antrum, there is a strong probability that other cavities are involved, and they should be at once explored and treated.

The longer the disease has lasted, the less likely becomes a cure by these simple methods, but no hard and fast time limit can be fixed: good results have been obtained in the most chronic cases. Instances are recorded in which a cure has been easily obtained of suppuration existing five, ten,

or even more years. One of these simpler methods should therefore be adopted in every case, however chronic, unless urgent reasons exist for a radical operation. To perform a radical operation straight off is, in my opinion, not justifiable. Even if these methods fail to effect a cure, the patient may yet feel so well that he prefers to remain as he is and continue daily irrigations, rather than undergo a more severe operation. In these circumstances, there is probably but little danger of further trouble, provided irrigation be continued regularly. Some of my patients have worn tubes for four, six, eight years, and even longer. Occasionally trouble may result: thus caries of the anterior wall of the antrum may ensue with swelling and abscess formation in the cheek, or an abscess may form in the hard palate. Sometimes the inner wall may necrose and produce a large communication between the antrum and the inferior meatus: this is rather an advantage than otherwise, as it may lead to a spontaneous cure. The most frequent cause of trouble is the formation of polypi in the antral cavity rendering irrigation impossible. The patient who declines to undergo a radical operation should therefore be warned of the above risks, and told that an operation may some time become necessary.

Radical Methods of Treatment. A more thorough operation is to be recommended (1) when there is distension of the walls of the antrum or inflammation of the overlying tissues; (2) when there is an external fistula communicating with the cavity; (3) when there are polypi, caries, or other disease of the antral walls; (4) when the sinus contains a foreign body; (5) when the continual secretion of pus seems to exert a harmful influence on the general health, or when it keeps up disease in the nose such as the recurrence of nasal polypus; (6) when the above-mentioned simpler methods have failed to effect a cure. In connection with this last point it is safe to assert that if the discharge has not greatly diminished after the first few washings, and if it continues in any quantity after three months' treatment, a cure can hardly be expected. It is true that a cure is occasionally reported after regular irrigations although they have been apparently unsuccessful for six months or even a year, but such cases are quite exceptional.¹

In performing a radical operation for the cure of chronic suppuration it must be borne in mind that the antrum is a large pyramidal cavity, with bony walls, and with a small opening near its apex. The rigidity of the walls will prevent the cavity collapsing, it is too large to become filled up with granulation tissue, and the opening does not allow efficient drainage. The situation of the antrum prevents any attempt to obliterate it, as such an operation would entail great deformity. The aim of any radical operation must therefore be to provide permanent free drainage and thus to induce the lining membrane of the cavity to return to its normal healthy condition. The objections to permanent drainage into the mouth are

¹ *Proc. Laryngol. Soc. of London*, 1898-99, vi. p. 18. Also Tilley two cases (private communication).

too obvious to require mention, and therefore the only method to be advised is the establishment of a large opening between the antrum and the inferior meatus of the nose.

The **radical operation** as usually performed was first described by Caldwell in 1893. Under a general anaesthetic a sponge with tape attached is pushed up into the post-nasal space, and another large sponge is placed between the teeth and the inner side of the cheek. The angle of the mouth being drawn up with a broad retractor, an incision is made at the junction of the mucous membrane of the gum and cheek, from opposite the second molar to the canine tooth. The incision is carried down to the bone, and the periosteum is stripped off above and below. With a chisel an opening is now made through the anterior wall of the antrum; a burr or a drill driven by an electric motor may be used if preferred. The opening should be enlarged with bone forceps until it admits two fingers, and its edges should be made flush with the floor of the sinus and with its anterior margin. This greatly facilitates the next step, which consists in cutting away the partition between the antrum and the inferior meatus of the nose. Caldwell made only a small opening with a drill, but it is much better to remove the whole of the wall between the antrum and the inferior meatus from the floor quite up to the attachment of the inferior turbinate. This may be done with an electric burr, with a chisel, or with cutting forceps such as Grünwald's. A little time may be required to complete this, and great care must be taken not to injure the inferior turbinate. Finally, the interior of the antrum must be examined with the finger for polypi, granulations or carious bone. Polypi, if found, must be removed, and any carious bone curetted. It is often recommended that the antrum should be examined by direct illumination, but in consequence of the free bleeding that occurs at this stage it is useless to attempt this. It is also recommended to scrape away the mucous membrane of the antrum in a "most thorough" manner. This I regard as a grave mistake, for, as has already been pointed out, the antrum cannot be obliterated, and consequently a cure depends upon the lining membrane returning to a normal condition, and the less the epithelial lining of the antrum is destroyed the more rapidly will this end be attained. Scraping only results in the formation of scar tissue covered with squamous epithelium.

Having completed the operation the antrum should be packed with strips of cyanide gauze. Luc has advised that a large drainage tube should be passed through the opening into the inferior meatus and out at the anterior nares and that the wound in the canine fossa should be sutured. The sutures are useless as the parts fall naturally together, while the tube is unnecessary if a large counter-opening has been made. Both tube and sutures are sources of irritation and discomfort. The large opening which I have described is permanent, and requires neither tube nor packing to maintain it. It greatly simplifies the after treatment, which

after the first few days can be safely carried out by the patient himself, and it gives rise to no subsequent inconvenience.

After Treatment. When there is no sign of extensive disease of the walls of the antrum, the packing may be removed on the second day—nitrous oxide being given if desired—and need not be replaced. The nose should be washed out daily two or three times, and the antrum at least once, until all discharge has ceased. The irrigation of the antrum may be conveniently carried out with the cannula and syringe above described (see page 319). This is, as a rule, the only after treatment required, and after a few days the patient may be instructed to do it for himself. When, however, much disease is present in the antrum, I think it is better to continue

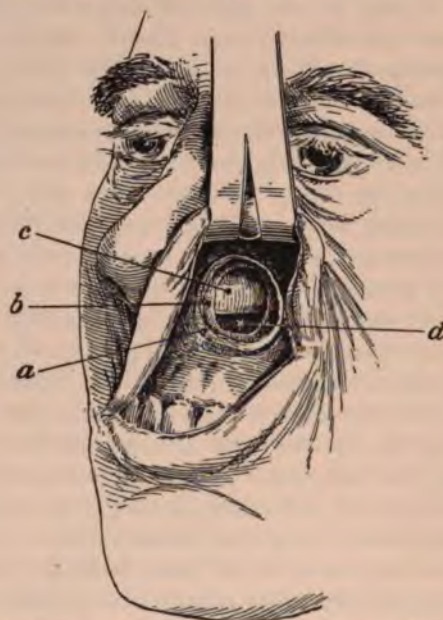


FIG. 112.—RADICAL OPERATION ON THE MAXILLARY ANTRUM. *a*, Outer wall of antrum; *b*, inner wall of antrum; *c*, inferior turbinate; *d*, inferior meatus.

the packing for ten days to a fortnight or more. Every second or third day the gauze is renewed and the interior of the antrum examined by direct illumination and by the probe. Any carious spots or granulations can thus be detected and scraped, or cauterized with chromic acid or silver nitrate fused on a probe. After ten days or so a large rubber or vulcanite plug may be fitted to the buccal opening and the gauze packing omitted. By this means an antrum may be kept under direct observation until all signs of disease have disappeared, when the plug may be removed and the opening into the mouth allowed to close.

Results. It is obvious that this operation serves to prevent the re-accumulation of pus in the antrum, even when this cavity is acting as a reservoir of pus coming from other sources, and although it may not

absolutely cease to secrete pus. However, with sufficiently prolonged and careful after-treatment a cure is almost always obtained.

Instead of the opening in the inferior meatus of the nose, it has been suggested that the natural orifice of the sinus should be enlarged, and the counter-opening made in the middle meatus.¹ An opening situated here is obviously less efficient for drainage purposes, and offers no compensatory advantage.

Other Methods of Resecting the Antro-Meatal Septum. The success of the above operation depends entirely upon the large opening which is made into the inferior meatus, and it is worth considering if this cannot be effected without making an opening through the canine fossa. The latter is certainly to be avoided if unnecessary, as it opens the tissues of the cheek to infection, and is almost invariably followed by a certain amount of pain and swelling. It must also delay the healing by leaving a raw surface on the outer wall of the antrum. Lothrop has proposed to cut away the wall dividing the antrum from the inferior meatus by means of suitably curved knives and chisels introduced through the anterior nares. He has operated on the cadaver, but apparently not on the living.

The narrowness of the nasal orifice and the close proximity of the lower edge of the inferior turbinate to the floor of the nose entirely prevent a view of the antro-meatal septum, and hinder the approach of instruments. To a large extent these difficulties may be overcome by removing the anterior end of the inferior turbinate, and by a free application of cocaine and suprarenal extract. With these aids I have recently operated entirely through the nose. The anterior end of the turbinate may be removed first: the second part of the operation, performed some days later, is thus rendered easier and is less disturbed by bleeding. If local anaesthesia only is used this subdivision of the operation is advantageous in every way, but if a general anaesthetic be preferred, the whole operation may be performed at one sitting. The method I have adopted is as follows:

Pledgets of wool soaked in suprarenal extract are packed all round the anterior end of the inferior turbinate and the patient is anaesthetized. A strong light is thrown into the nose, and about half an inch of the anterior end of the inferior turbinate removed with scissors and snare (see page 146). The turbinate should be divided from the outer wall of the nose as close to its attachment as possible, and the spokeshave may be employed to pare down any ridge which is left. The outer wall of the inferior meatus is thus brought into view. Two parallel horizontal cuts are now made, one close up to the attachment of the inferior turbinate, the other close to the floor of the nose. These are connected by a vertical cut in front, and the quadrangular semi-detached piece of bone grasped with forceps and removed. The incisions are conveniently made with two specially strong knives with their blades set at right angles to narrow steel handles (see Fig. 113). When

¹ Gerber, *Archiv für Laryngol.*, 1905, xvii. p. 56. Also Alsen, see reference at end of chapter.

this piece of bone has been removed it is usually possible to see into the antrum, and to inspect its posterior wall. If the nostril be not too narrow the finger also may be introduced, the interior of the antrum explored, and any obvious disease curetted. If desired, the antrum may be packed for 24 hours. Subsequent treatment consists of daily irrigations carried out as above described.

I have performed this operation on ten occasions, and the results have been so good that I should strongly recommend it in future. It has all the advantages of Caldwell's method, except that it is much more difficult to perform. It does away with the grave disadvantage of making



FIG. 113.—A. AUTHOR'S RIGHT-ANGLED ANTRUM KNIVES OR CHISELS. B. HAJEK'S HOOK. C. HAJEK'S CHISEL. All the instruments fit into Hajek's Handle.

a large opening in the mouth and leaving a raw surface on the interior of the antrum which delays the healing.

Previously, I had attempted to resect the antro-meatal septum after exposing it by performing a preliminary Rouge's operation. This operation gives fair access to the parts, and it leaves no deformity. It is, however, extremely difficult to avoid injury to the inferior turbinate, while the operation is more difficult and requires more time than that above described. If the anterior end of the turbinate be removed, Rouge's operation becomes unnecessary. I have performed it only on three occasions, and the results did not encourage me to continue.

Küster's Operation. Before the method of Caldwell was introduced the surgeon relied upon a simple large opening through the canine fossa for the cure of the most obstinate antral cases, and this operation has been recommended up to quite recent times by Hajek, Grünwald, and others. An opening of half an inch or more in diameter is made through the canine fossa in the way above described. The interior of the antrum is examined with the finger, and any polypi are removed and any carious bone curetted. The antrum is then packed with strips of gauze, which must be changed

every second day. During healing the interior of the antrum is frequently examined by illumination and with a probe, and any granulations scraped or cauterized. This treatment is continued until the entire lining membrane is healthy, and covered with epithelium. After ten days or a fortnight the gauze packing may be omitted, and the opening into the mouth maintained by means of a specially made rubber or vulcanite plug. The disadvantages attaching to curettement of the mucous membrane of the antrum apply as forcibly to this as to Caldwell's operation, but even when the greatest care is taken to preserve the membrane intact, a cure is uncertain and tedious. Hajek reports the results of 25 cases: of these only 5 had been under observation long enough to be relieved. Of the 5, four were cured after eight months' to a year's treatment: these results are far from brilliant. Jansen considers six months to two years necessary to obtain a cure. It is quite obvious that suppuration is much more liable to continue and to recur when the only permanent exit for the secretion is through the small ostium at the apex of the cavity, than when a large permanent opening has been made in the lowest part. It would be well if this operation were to be entirely abandoned.

Lastly, Bönninghaus has proposed to open the antrum widely through the canine fossa, to curette away the entire lining membrane, and then to remove the skeletal parts of the inner wall of the antrum, including the inferior turbinate bone. The soft parts forming the wall between the antrum and the nose are then pressed outwards into the antrum to form a new lining membrane. This is obviously an exceedingly difficult, tedious procedure, and one for which there seems no necessity.

The following works may be consulted:

- GERBER. *Archiv für Laryngol.*, 1905, xvii. p. 56.
 ZIEM. *Therap. Monatshefte*, 1888, vol. ii. pp. 148, 222.
 FRIEDLÄNDER. *Berlin. klin. Woch.*, 1889, xxvi. p. 815.
 CALDWELL. *New York Med. Journ.*, 1893, lviii. p. 526.
 SCANES SPICER. *Journ. of Laryngol.*, 1895, ix. pp. 374 and 381.
 WEIL. *Journ. of Laryngol.*, 1896, xi. p. 269 *et seq.*
 LUC. *Journ. of Laryngol.*, 1897, xii. p. 502.
 LOTHROP. *Boston Med. and Surg. Journ.*, 1897, cxxxvi. p. 455.
 WARNECKE. *Archiv für Laryngol.*, 1900, x. p. 255.
 JANSEN. *Archiv für Laryngol.*, 1894, i. p. 135.
 BÖNNINGHAUS. *Archiv für Laryngol.*, 1897, vi. p. 213.
 GRÜNWALD. *Archiv für Laryngol.*, 1899, ix. p. 431.
 ALSEN. *Archiv für Laryngol.*, 1902, xii. p. 227.
 LERMOYEZ. *Journ. of Laryngol.*, 1902, xvii. p. 571.
 TILLEY. *Clinical Journal*, 1897, ix. p. 385.
 TILLEY. *Journ. of Laryngol.*, 1902, xvii. p. 582.
 TILLEY. *Journ. of Laryngol.*, 1904, xix. p. 66.
 ONODI. *Archiv für Laryngol.*, 1903, xiv. p. 154.
 STURMANN. *Berlin. klin. Woch.*, 1902, xxxix. pp. 684-689.
 CALDWELL. *Medical Record*, 1893, April 8th.
 ZIEM. *Monatschr. für Ohrenheilk.*, 1886, Nos. 2, 3, 4.

CHAPTER XX.

THE TREATMENT OF SUPPURATION IN THE ETHMOIDAL CELLS.

SUPPURATION in the ethmoidal cells even when limited almost invariably requires operation. It is perhaps more liable to give rise to serious consequences than suppuration in any other of the accessory sinuses. The affection may slowly extend from cell to cell, or even spread to the antrum or to the frontal sinus. It is frequently associated with nasal polypi, and removal of the polypi is sure to fail unless the ethmoidal cells are opened at the same time. The patients are frequently debilitated and incapacitated from earning their living, especially when this involves mental labour. Headache, inability to fix the attention, mental depression and similar symptoms, are common. Orbital and cerebral abscess are more frequent in ethmoidal than in other sinus affections.

The treatment presents special problems. The ethmoidal cells form a collection of thin-walled cavities, lying chiefly in the outer and upper part of the nose, above and to the outer side of the middle turbinate. The cells are separated by very thin bony plates from the brain cavity and from the orbit. Free access to the ethmoidal cells requires an extensive external operation which may result in disfigurement, and therefore in the majority of cases they must be reached from the nose. This entails the difficulty of working through a deep narrow passage. Complete removal of the ethmoidal cells apparently leads to no ultimate ill result.

The operative methods at our disposal may be divided into (1) minor intranasal operations such as the opening of one or two cells under local anaesthesia with sharp hooks, or with cutting forceps; (2) extensive removal of the ethmoid by curettement; and (3) external operation. The method to be adopted depends upon the extent and situation of the disease. Thus we must consider the treatment of

- (1) Suppuration limited to a few cells, anterior or posterior.
- (2) Extensive ethmoidal disease, and
- (3) Ethmoidal suppuration associated with orbital fistula or abscess, or with cerebral complications.

Limited Suppuration of the Anterior Ethmoidal Cells. When suppuration

in the anterior ethmoidal region seems limited to a few cells, an attempt may be made to cure it by a small operation under cocaine anaesthesia. In the first place any polypi or other hypertrophies must be removed. The snare should be hitched up as high as possible around the base of the growth, the wire drawn tight, and the polypus torn rather than cut away, so that if possible a piece of bone may be brought away with it; by this means an ethmoidal cell may often be freely opened and the removal of the polypus is followed by a discharge of pus. In the next place the anterior half of the middle turbinate should be removed in order to clear the approach to the ethmoidal cells. After a short interval to enable the inflammatory reaction to subside and all oedema to pass off, the parts should be thoroughly anaesthetized with cocaine and suprarenal extract, and the affected cell or cells carefully located. These cells are then opened with a sharp hook, such as Hajek's. The hook is passed into the cell and then the cell walls are broken down by traction. The cell being opened its walls may be cut away with Grünwald's or similar forceps. If there is not much bleeding the interior of the cell can be inspected, and the lining membrane, when diseased, may be curetted, but in my opinion it is better to avoid the curette as much as possible. Unless the mucous membrane be very extensively diseased it will soon become healthy when free drainage is provided, and its removal by baring the bone only delays the cure and opens the door to the spread of infection. If the mucous membrane be extensively diseased the bone is probably also affected, and a cure is more rapidly and more certainly obtained by removing both together. When one or more cells have been opened a further interval is necessary to allow the inflammatory reaction to disappear. Considerable oedema is commonly set up and may last two or three weeks; this must be allowed to subside before further operation is undertaken. During this period the patient should use simple nasal washes such as the alkaline lotion or weak boracic acid solution. The nose should never be packed. Haemorrhage even if profuse very soon ceases and packing is dangerous, as it prevents the free outflow of pus, and consequently may dam it back into other cells.

The danger and uselessness of using the galvano-cautery to destroy diffuse hypertrophies or oedema in ethmoidal disease need not be insisted upon. As I have already pointed out in discussing the treatment of nasal polypi, it merely serves to increase the trouble it was meant to cure.

The great **objection to intranasal methods** is that they allow of very little being done each time, consequently a large number of sittings are required, and the treatment is very prolonged. Bleeding quickly obscures the view, and the patient soon becomes intolerant, as in this region the anaesthetic effects of cocaine rarely extend deeply, and the pain is never completely removed. The advocates of this method, even those who maintain that there is no alternative treatment, admit that the pain and tediousness often drive patients to give it up as soon as the most

urgent symptoms have been removed. Hajek states that in a considerable number of his cases the suppuration continued in spite of the fact that he had often taken great trouble to obtain a perfect cure. In fifteen obstinate cases he only obtained a complete cure in three, and does not think that the results were worth the sacrifice of time and trouble. Two of the cases which were cured required more than a year, and the third more than half a year of continuous treatment. He concludes therefore that a certain number of cases are incurable by intranasal methods, and that a *half-cure* is the most that can be expected or should be aimed at when the disease is extensive. After the pain, headache or other acute symptoms have disappeared, he would keep the case under observation, remove polypi or other obstructions to the outflow of pus from time to time as they recur, and let the discharge continue. This candid report is, I believe, in accordance with general experience. Further than this, I believe that the sum total of the danger of repeated small operations is as great as that of a single, more severe, but curative measure. The pain and the septic absorption which occur at every fresh operation gradually undermine the patient's health, the nervous depression and debility to which these patients are so liable is increased, and severe neurasthenia or nervous breakdown is not uncommonly produced. The method, however, may be employed with advantage when the disease appears very limited, and when a cure may be anticipated after a few sittings. It is also the best method when acute symptoms are present, and when from age or other reasons a more radical procedure must be avoided. In extensive disease it is both inadequate and dangerous.

When there is **limited disease of the posterior ethmoidal region** similar methods may be adopted. The whole middle turbinate must first be removed, together with any polypi that may be present. Then the affected cells having been located, they may be opened by means of Hajek's hook, and the walls cut away with forceps. Removal of the middle turbinate is always painful under local anaesthesia, and is difficult to accomplish without the use of some such instrument as the spokeshave. Even with limited disease, therefore, I prefer to operate under general anaesthesia; gas, or gas and oxygen, is sufficient. The patient may be seated upright in the ordinary rhinoscopical position, or may lie upon a couch. The operation is performed under full illumination by reflected light. The spokeshave is passed over the posterior end of the middle turbinate, and this structure removed by sharply hooking it forward. A ring knife is then quickly introduced, and the affected cell, or cells, broken into and their walls curetted away. This little operation may be quite quickly and yet safely performed. It is much more thoroughly accomplished in the short time allowed by nitrous oxide anaesthesia than under cocaine.

The **after-treatment** consists in doing as little as possible. The dangers of packing I have already alluded to, and it should never be employed unless absolutely necessary to stop bleeding. If it be necessary

it must be removed the following day and not replaced. After twenty-four hours the nose should be gently irrigated two or three times a day with a weak solution of boracic acid or other mild antiseptic. The patient need not be confined to bed, and after a few days may resume his usual occupation.

When **many ethmoidal cells are affected** minor operations seem to me utterly inadequate. Numerous polypi or extensive polypoid degeneration of the mucous membrane are usually present, and the only treatment which offers a fair chance of success is a radical operation similar to that described for the removal of nasal polypi associated with extensive ethmoidal disease (see p. 195).

Operation by Curettement. A few details only will be emphasized here. The anaesthetic, preferably gas and ether, followed when necessary by chloroform, should not completely abolish the reflexes. It is most important that the patient should be able to swallow and to cough up any blood which enters the air passages. When possible, that is when the posterior ethmoidal region is not affected, a large sponge should be pushed up into the post-nasal space to prevent blood entering the back of the throat. The larger polypi may be removed with polypus forceps, and then ring knives, such as Meyer's original adenoid curette, are used. These curettes are more effective than any sharp spoon, more can be removed with them, and less force is required. The cutting edge should be directed outwards, and fairly firm pressure may be exerted in this direction without danger. Should the orbital plate of the ethmoid be perforated and the periosteum laid bare no ill effect need follow. If the curette be carefully introduced with the blunt edge flat against the septum and passed up very gently into the nose until it meets with resistance it is quite possible to reach the uppermost of the ethmoidal cells without any risk of perforating the cribriform plate. The cutting blade should never be directed upwards: this point I wish to insist upon most strongly, as on it depends the safety of the operation.

The scraping in an outward direction must be continued until all the soft bone has been removed. The finger should be introduced, if possible, to feel the progress that is made: it will often be found that a large opening has been broken into the maxillary antrum. The inner wall of the orbit should also be explored for perforations. As soon as all the degenerated bone and mucous membrane have been removed, the curette comes down upon hard smooth bone, which is extremely difficult to scrape away. Healthy bone can be easily recognised, as it gives rise to quite a distinct feeling from diseased bone. On completing the operation, it is usually advisable to puncture the antrum for exploratory purposes, unless this has been done previously.

After-Treatment. Haemorrhage is often very brisk, but usually ceases quickly if the patient's face be sponged with ice-cold water. The nose should not be packed unless it is absolutely necessary to arrest the bleeding:

the packing should be removed the following day and not replaced. It prevents the free outflow of pus, and thus predisposes to septic infection, and to disease of other sinuses. Certainly septic complications seem less common in my practice since packing has been discontinued. After the first twenty-four or forty-eight hours the nose may be gently irrigated with a weak antiseptic lotion such as boracic acid solution. Syringing, if force be used, may produce otitis media, and therefore must be carefully employed.

Results. In the majority of cases a cure is obtained, and a large dry cavity lined by a smooth, white membrane forms in the upper part of the nose. Sometimes the entire disease may not have been removed, or other sinuses such as the frontal or sphenoidal sinus may be affected, and subsequently require operation. Usually healing is complete in from two to three months after the operation.

Dangers. I do not wish to exaggerate the advantages of this operation, but rather to emphasize its dangers, and the necessity for caution in performing it. The following, as far as I am aware, is a full account of the ill-results that have been reported. At least three deaths have occurred. Of one I have obtained no details; one was due to polypus forceps having been pushed through the cribriform plate, and therefore was not directly due to this operation at all; the third was due to fracture of the cribriform plate from scraping with the ring knife. I have performed the operation myself during the past eight years upon more than 150 patients without any fatal results. Occasionally there was a rise of temperature to 101° F., or even higher, for a few days after the operation. This was probably due to slight septic absorption from the raw surfaces, and has been much less frequent since the practice of packing the nose has been discarded. In one or two cases a temperature of 103-104° has been noted, but it has usually fallen within 48 hours, and has never been attended with serious trouble. Suppurative otitis has occurred a few times, but only when the patient has previously suffered from the same disease.

Occasionally adhesions have formed between the outer wall of the nose and the septum. Sometimes these have been mere strands, which, when complete healing had taken place, could be easily divided with the galvano-cautery. In one or two cases they have been more extensive, but beyond obscuring the view of the upper part of the nose, apparently caused little inconvenience. They may have resulted from unusually acute inflammation after the operation, but in all probability they were due to injury of the septum. With care they may probably be avoided. In only one of my cases has a serious result followed. Three weeks after the operation, and ten days after the patient had left the hospital, an abscess formed in the lower and inner part of the orbit in connection with the nasal process of the superior maxilla and had to be opened externally. For three months a sinus existed and then a free incision was made into the orbit, a sequestrum removed and the patient did well. This was a case of extensive suppuration of the ethmoidal cells and of the antrum, and on

operating upon the ethmoid the orbital periosteum was extensively laid bare.

Another case has been privately reported to me in which optic neuritis and blindness followed ethmoidal curetting. The operation was carefully performed by an able man. Shortly after, the patient had severe optic neuritis and rapidly lost her vision. The cause seemed doubtful. It might have been due to thrombosis of the cavernous sinus and ophthalmic vein. Killian has reported similar cases following other nasal operations. In the absence of further data the most probable explanation seems to be the rapid loss of blood which certainly may occur in this operation, and, as is well known, may produce optic neuritis. Or it may be that the optic nerve lay in close relationship to one of the posterior ethmoidal cells, that the thin bony partition was fractured and the nerve injured (see Fig. 16).

These ill-results, although undoubtedly serious, seem to me small compared with the severity of the disease for which the operation is performed. The fatal results, so far as is at present known, were due to avoidable causes, and prolonged experience proves that the operation, when properly and carefully performed, is both safe and efficient. Up to the present time nothing has been devised which can replace it.

Manifest or Complicated Ethmoidal Suppuration. If urgent cerebral symptoms, or an abscess or fistula in the orbit be present, an external operation should be performed. In rare cases, when there is severe headache with acute pain but without definite sign of cerebral complication, it has been recommended that an intranasal operation should be tried in the first instance. Cocaine anaesthesia is used, the anterior end of the middle turbinate removed, and the ethmoidal cells opened freely until pus is evacuated. It seems possible that this procedure might avert serious symptoms and avoid an external operation, but I have had no personal experience. When an abscess is actually present in the orbit external operation must not be delayed. A general anaesthetic is given, the post-nasal space is packed with a large sponge, the eyebrow shaved and the skin purified in the usual way. An incision is made just below the line of the eyebrow, commencing near the supra-orbital notch and is continued in a curved direction downwards and inwards to about a quarter of an inch below the inner canthus. The incision is carried down to the bone and the periosteum detached from the inner wall of the orbit as far back as necessary. In this way the abscess in the orbit is opened and the perforation of the lamina papyracea through which it communicates with the ethmoidal cells will be exposed. With a fine chisel, cutting forceps, or sharp spoon the bone should be cut away to expose the ethmoidal cells. With a ring curette, introduced either through the opening thus made or through the nose, and guided by the finger in the wound, the ethmoidal cells can be definitely and precisely broken away as far back as the sphenoid. The bleeding is free, but by frequent sponging every step of

the operation can be carried out under full view. The wound should be closed with a few silkworm gut sutures, allowing an interval for the passage of a large tube, which is brought out at the anterior nares. After a week or so the tube may be replaced by a silver tube similar to that recommended for frontal sinus disease (see Fig. 116). The tube is removed daily for syringing, and the nose is also irrigated once or twice daily. No further after-treatment is required. The results are excellent, a complete cure is obtained and the resulting scar is not very unsightly. Still I should not be disposed to consider this operation as an alternative to the one above recommended for all cases of extensive ethmoidal cell disease.

Conclusions. From the above considerations I think the following conclusions may be drawn :

That minor operations under cocaine anaesthesia are to be recommended only in cases of very limited disease.

That curettement of the ethmoid with ring knives is the best operation for the large majority of cases.

That external operation is safest and best when cerebral or orbital complications are present.

The following may be consulted :

GRÜNWALD, LACK, etc. Brit. Med. Assoc. Meeting, August, 1902, reported in the Journ. of Laryngol., 1902, xvii. p. 598, etc.

FISHER. (Case of orbital abscess) St. Thomas Hospital Reports, 1897, xxvi. p. 79.

GRÜNWALD and HAJEK'S Works (see page 266).

CHAPTER XXI.

TREATMENT OF CHRONIC SUPPURATION IN THE FRONTAL SINUS.

THE treatment of chronic suppuration in the frontal sinus presents some difficult problems, and is still the subject of controversy. Whilst some hold that intranasal methods should be adopted, and condemn external operations, others believe that an external operation affords the only reasonable hope of cure. Confirmatory statistics can be quoted by the adherents of either view, but all statistics are invalidated by the fact that a certain diagnosis is generally impossible until an external operation has been performed. The truth probably lies between these extreme views. Although it is impossible to be sure that suppuration in the frontal sinus will yield to intranasal methods, there is the strongest probability in favour of it. This view is supported by surgeons of large experience, and is confirmed by the success obtained by similar treatment of other sinuses.

Intranasal Methods. Intranasal treatment may be considered under the following headings:

Removal of the middle turbinate and of any polypi or other hypertrophies in the middle meatus so as to clear a free approach to the infundibulum.

The introduction of a cannula through the infundibulum and irrigation of the frontal sinus.

Puncture of the sinus from the nose.

Removal of the Middle Turbinate, etc. However strongly frontal sinus suppuration may be suspected, care must be taken to exclude suppuration in the antrum and anterior ethmoidal cells. The presence of pus in the antrum must be eliminated by puncture and irrigation of this cavity. This is a point which cannot be too strongly insisted upon. Tenderness and even swelling in the supra-orbital region, frontal headache and pain may all be due to suppuration in the maxillary antrum (see pp. 89 and 291). The next point is to exclude ethmoidal suppuration. This necessitates the removal of the anterior half or more of the middle turbinate, and of any polypus or other swelling in the middle meatus. Having done this, it is better to wait a week or so, and then, if suppuration continues when

all inflammatory disturbances have subsided, to curette the ethmoidal region thoroughly under general anaesthesia. The anterior ethmoidal cells, including the bulla ethmoidalis, must be broken down and the uncinat process removed. In this way the lower end of the infundibulum is thoroughly opened up. It might seem at first sight that this treatment was unnecessarily severe, but it must be borne in mind that the diagnosis still remains in doubt, and that even if frontal sinus suppuration alone be present, the removal of the anterior ethmoidal cells is necessary for its cure. Another interval of three or four weeks must be allowed for the healing of the wound in the upper part of the nose, and for the disappearance of the inflammatory oedema. During this time the nose should be cleansed regularly twice or three times daily by irrigation with alkaline or mild antiseptic solutions.

Results. The operation allows free drainage from the frontal sinus, and may suffice to effect a cure, especially in recent cases. I have had several cases in which acute symptoms have been immediately relieved, and a few in which all discharge has ceased. It even seems probable that a cure of chronic frontal sinus suppuration is occasionally effected. Thus Hajek reports that by this means alone in 25 cases of recent disease, all were relieved, and many cured; in 27 chronic cases, 9 were cured, and all relieved. Although, as above said, these and similar statistics are invalidated by the fact that the diagnosis is uncertain, the treatment is thoroughly justified as in nearly every case of frontal sinus suppuration the fronto-ethmoidal cells will be found involved. Unless urgent symptoms are present, intranasal treatment therefore should always be adopted in the first instance, as it may save an external operation. Should it fail, and should a considerable quantity of pus still continue to come down from the anterior part of the middle meatus, the question of further treatment must be considered.

Intranasal Irrigation. The next step in intranasal treatment consists in washing out the frontal sinus through a cannula passed up the infundibulum. A study of the anatomical relations of the parts showed that there was great difficulty in passing a probe into the normal frontal sinus, that the manœuvre was only possible in about 25 per cent. of skulls, that there were no means of knowing when it would be possible, and no certainty in any given case, that the probe had entered the sinus, however far it had passed up into the nose (see p. 18). But when the fronto-ethmoidal cells are broken down, and the approach to the infundibular region thoroughly cleared as above described, the passage of a suitably curved instrument is much facilitated, and with care will probably succeed in about 50 per cent. of patients. The want of an absolute criterion that the probe had really entered the frontal sinus, rather than slight differences in the methods practised, probably accounted for the great divergence of opinion amongst the older rhinologists. Lothrop, in an exhaustive article already quoted, showed that probing was only possible in about one in four normal sinuses, and that it was always a matter of great difficulty and uncertainty. Until the sinus had been opened externally, it was impossible

to be certain that the probe had really entered the cavity. Owing to the anatomical irregularities, no certain rules or guides could be laid down. In disease, however, these conditions are altered, the infundibular passage is frequently dilated as the result of rarefying osteitis and destruction of the ethmoidal cells, and the passage of a probe is frequently easy. Further, the spot from which the pus exudes into the nose forms a certain guide as to the direction in which the probe should be passed. Of late years the X-rays have provided a reliable means of ascertaining the position of the probe. In photographs taken by this means the position and extent of the frontal sinus can be accurately observed, and I have frequently passed a probe into the sinus, and by means of a photograph or of the fluorescent screen, have been able to determine with absolute certainty, that it had entered the frontal sinus (see Fig. 114). Later observations show beyond all doubt, that in disease the probing of the frontal sinus is relatively easy and can be carried out in the large majority of cases, as the older clinical observers had indeed maintained.

Method. An easily bent probe should be first used, and insinuated gently in various directions until it is found to enter the sinus. The most suitable curve to give the probe, the direction in which it passes most easily, and any obstructions met with in its passage, should be noted. A flexible cannula, about the calibre of a Eustachian catheter, should be bent to the same shape as the probe and retained entirely for the patient's use. Hartmann recommends that the probe be bent at an angle of 135° an inch and a half from its tip, but the most suitable curve is best ascertained by careful experiment on each patient.

The cannula being inserted, the sinus is washed out with a mild antiseptic, such as boracic acid solution. Other antiseptic fluids may be used, and formalin has been strongly recommended; but in the first instance unirritating lotions are the best. If simple boracic fails I prefer hydrogen peroxide used in the way above described (see page 315). Having cleansed the sinus and sucked out any remaining fluid, Symonds has suggested laying the patient on a table with his head hanging well down over the end, and then filling up the frontal sinus through the cannula with iodoform emulsion. Hajek recommends that the sinus be occasionally irrigated with a 2.5 per cent. solution of copper sulphate (see page 315).

The **objections** to the employment of this method are that the treatment must be carried out daily by the surgeon himself; that it generally fails to produce other than temporary benefit; that in some cases delay in performing a radical operation is dangerous, namely, when there is caries of the posterior wall of the sinus; and finally, that the method is dangerous in itself. There is, however, probably little risk when there is free communication between the sinus and the nose, and fortunately these are just the cases in which irrigation is most easy. With great care and the avoidance of all force the danger of perforating the floor of the skull is slight, but although it can hardly be demonstrated, there may be a risk of infecting a healthy

sinus by passing a cannula through a suppurating region to reach it, for, as already emphasised, the diagnosis is uncertain. Where there is difficulty in entering the sinus it is wisest to desist: it is never right to employ force.

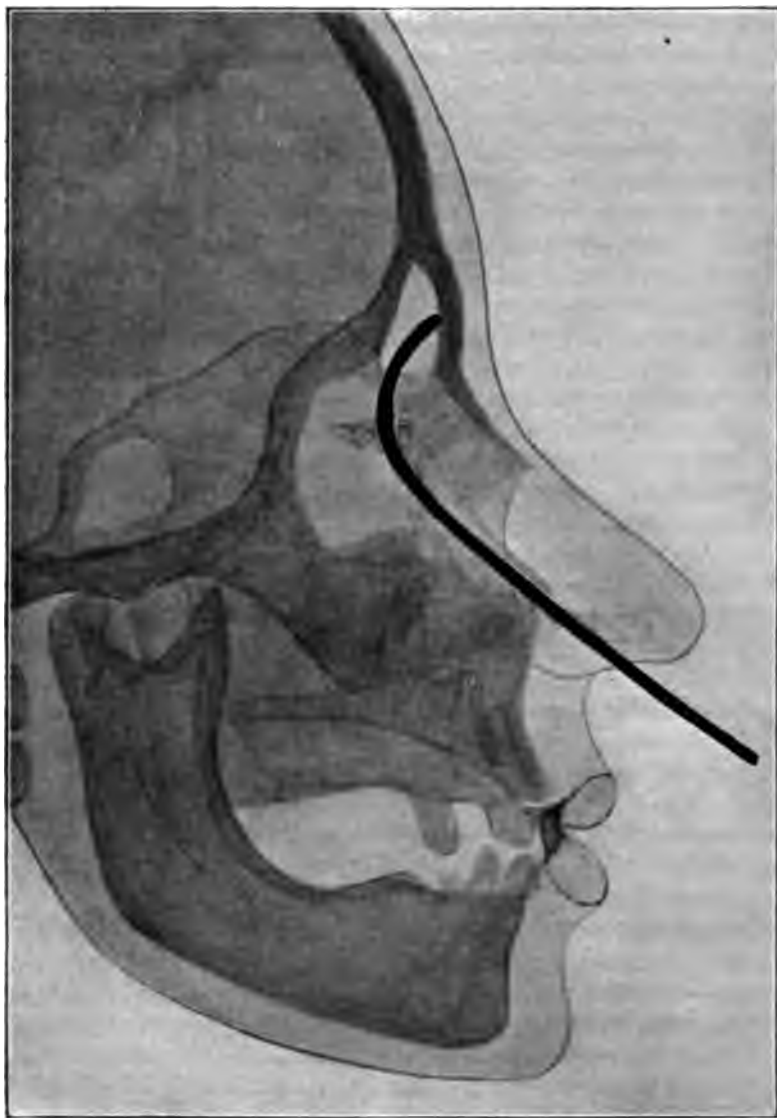


FIG. 114.—CANNULA PASSED INTO FRONTAL SINUS. From an X-ray photograph.

As to the **results** of this method of treatment there is great divergence of opinion. I have adopted it in eight chronic cases, washing out the sinus daily for two or three weeks. One was cured, three were considerably

improved, in one of which the discharge almost ceased; in the remaining four there was merely temporary benefit. Lichtwitz treated 17 cases by this method—one was cured and all were relieved; Hartmann thinks irrigation will cure the majority of cases; Charters Symonds reports one success in three cases. Lothrop, MacDonald, Dundas Grant, Sergeant Snow and others speak hopefully of it. Hajek thinks the majority of acute cases can be cured by this means. Personally I should recommend it only under very exceptional circumstances. When the affection is recent, the symptoms not acute, the method easy, and the patient willing to submit to daily visits, it might be tried for a time. In my one successful case the patient quickly learnt to irrigate the sinus for himself, and in less than a week there was marked decrease in the discharge.

Puncture of the Floor of the Sinus from the nose was first recommended by Dieffenbach, and subsequently adopted by Schäffer, with whose name it is generally associated. Schäffer claimed to have cured 18 out of 25 cases, and Winckler 6 out of 15 by this method. Other observers could reach the sinus in only a small number of cases. The floor of the sinus may be punctured from the middle meatus, as recommended by Killian, or from above the middle turbinate, as Schäffer suggested; the latter is by far the more difficult and dangerous. Schäffer recommends that the cannula should be forcibly pushed into the sinus, the sensation of passing into the cavity being easily recognisable by the crackling of the bone and the sudden yielding of resistance. But as already shown the frontal sinus may be absent, and Mermod, who attempted the operation in such a case, perforated the dura mater and caused fatal meningitis. Two other fatalities are on record, and the method must always be uncertain and dangerous. More recently Gustav Spiess has revived this operation. He recommends cocaine anaesthesia, and operates with an electric drill, guided by the X-rays in a darkened room. The passage of the drill into the sinus is seen upon the fluorescent screen. He reports many successful cases, and Moritz Schmidt speaks highly of the method. Still even this modification seems to me unjustifiable. As will be seen later, certain external operations which provide much freer intranasal drainage almost invariably fail to cure. The opening thus made, even if large at the time, will rapidly contract and become useless for drainage purposes, whilst the danger of the operation must be considerable.

External Operation. When the above means of treatment fail the question arises whether it is better to leave the patient alone or to perform an external operation. Unfortunately experience has shown that these operations are by no means free from danger, and that some methods fail to cure. On the other hand the risk of leaving the disease alone does not appear to be great, provided free drainage be maintained. In many of my cases suppuration has existed for ten, twelve, or even sixteen years without impairing the patient's general health or causing him serious inconvenience. As already seen, changes in the bony walls of the frontal

sinus are seldom found, and cerebral complications are extremely rare. Therefore, when no symptoms are present other than nasal discharge, the facts must be clearly put before the patient, and it must be left to him to decide as to operation. Under these circumstances he may decline it, in which case he should be seen from time to time, so that any polypi may be removed, and free nasal drainage maintained.

On the other hand operation may be required for one or more of the following reasons. **Pain**, which may be severe. Sometimes it is described as maddening, and though intermittent may last hours or even days at a time, and totally incapacitate the patient. In other cases there is frequent severe headache, rendering the patient unable to work or to attend to household duties. More than half my patients sought relief for this reason. **Deficient drainage.** The opening into the nose may be small and frequently blocked: in these circumstances delay in operating is dangerous. **Bulging of the cavity** or a discharging external fistula. These conditions imply disease of the bony walls, and naturally demand operation. Symptoms of **cerebral trouble** are an urgent indication for operation. **General ill-health**, if apparently due to the disease.

The main **objections** to an external operation are that the operation itself is dangerous; that in the past a cure has been by no means certain; and that the resulting deformity is often great. As operative methods improve, become less dangerous and more certainly curative, it is to be hoped that it may be possible to advise operation in almost every case in order to stop the nasal discharge and to remove the liability to subsequent complications.

The following are some of the more important methods of operation that have been recommended:

Method of Ogston. Ogston has an undoubted claim to be considered the pioneer in the surgery of the frontal sinus. In 1884 he reported three cases on which he had operated: in two the result was successful: in one it is not given. He made a vertical median incision running from the root of the nose upwards on to the forehead for about an inch. Having opened the frontal sinus by trephining, he enlarged the ostium and infundibular canal with a gouge, and passed a tube the size of a crow-quill into the nose, leaving its upper end in the sinus. The external wound was closed and the tube retained for a week. Ten years later, in 1894, Luc published cases in which he had adopted this method, and the operation is generally known at the present day as the "Ogston-Luc." Luc used the incision in the supra-orbital ridge and recommended a funnel-shaped tube so that it might be more easily retained in the sinus; still the principle of his operation is essentially the same as that devised by Ogston.

Method of Jansen. Jansen makes an incision parallel to and a little below the supra-orbital margin, turns back the periosteum from the roof of the orbit, and removes the entire inferior wall of the frontal sinus. He then scrapes away the lining mucous membrane and cures the infundibulum.

to establish a free communication with the nose. He relies chiefly on external drainage, and trusts to the orbital fat to bulge upwards and fill the cavity. Healing is often slow, especially with large sinuses, and it may be found necessary to reopen the wound and to cut away some of the anterior wall in order to reach recesses. The objections to this method are that the removal of the inferior wall alone renders it difficult to see into the sinus properly, to explore its various recesses, to remove the whole of the mucous membrane, and to get at the infundibulum. With large sinuses healing is very slow, and considerable deformity ensues: with small sinuses the results are good.

Method of Kuhnt. Kuhnt makes an incision along the supra-orbital margin from the bridge of the nose to the outer third of the orbit. He turns back the periosteum from the anterior wall of the sinus, removes the entire anterior wall, and scrapes away the mucous membrane. He then removes the nasal portion of the floor of the sinus, curetting the infundibulum and the anterior ethmoidal cells so as to establish a free communication with the nose. He relies chiefly upon external drainage.

Method of Killian. Killian's original method was to make an incision along the supra-orbital margin, to open the sinus through the anterior wall, and explore it. He then prolonged the incision downwards and inwards to below the inner canthus, chiselled into the nose along this incision and displaced the nasal process of the superior maxilla outwards. Having passed a probe down the infundibulum he removed all the bone between the outer wound and the probe, thus making a large communication between the frontal sinus and the nose. He replaced the bony flap, closed the lower part of the wound, and packed the sinus with iodoform gauze. The gauze packing was gradually diminished in amount as the sinus closed: Killian's later method consists in making a similar incision and in removing the greater part of the anterior wall but leaving the supra-orbital margin; the inferior wall of the sinus is then exposed and removed. In this way a narrow bridge of bone is left in the position of the supra-orbital margin, which prevents the subsequent sinking in of the soft parts. The entire mucous membrane of the sinus is removed, and the infundibular region opened up in the way above described.

Many slight modifications of these methods have been introduced. All the operations fall under four heads. (1) Simple opening of the cavity and external drainage. (2) Opening of the cavity, enlargement of the infundibulum or complete removal of the nasal portion of the floor of the sinus, with immediate closure of the external wound and provision of nasal drainage only. (3) The above operation with both external and nasal drainage. (4) Obliteration of the sinus.

The method of treatment I would recommend consists briefly in opening the sinus through its inferior wall, and in thoroughly exploring it. If the sinus be small, or extensively diseased, it is obliterated by removing the whole of the anterior and inferior bony walls. The mucous membrane

is scraped away; the anterior ethmoidal cells and the nasal portion of the floor of the sinus are broken down, so as to establish free communication with the nose. Both external and nasal drainage are provided until healing has taken place. If, on the other hand, the sinus be large, the disease recent, the bony walls not affected and the prevention of deformity important, the sinus is simply opened, the mucous membrane is left as far as possible intact, a large communication is made with the nose, and both external and nasal drainage provided until suppuration has ceased. When the opposite conditions prevail and obliteration of a large sinus is necessary, Killian's method should be preferred.

Operation. The eyebrow is shaved and the skin purified in the usual way. A large sponge with a tape attached to facilitate its removal is passed through the mouth and tightly packed into the post-nasal space, so as to prevent blood entering the air passages. The incision follows the line of the eyebrow, parallel to and just below the supra-orbital margin. A vertical incision enables both sinuses to be reached through one wound, but allows exposure of their anterior walls only; when a small opening is made here the resulting deformity is slight, but a large opening leaves a very unsightly depression. The incision along the line of the eyebrow or a millimetre or two below it allows free exposure of both the anterior and inferior walls of the sinus, and may be conveniently prolonged downwards towards the inner canthus, thus allowing free access to the infundibulum and anterior ethmoidal region; the resulting scar is hidden by the eyebrow; even a small depression in this situation becomes in time hardly noticeable. The incision gives free access to the parts, and can be easily extended as far in an outward direction as necessary. When both sinuses are affected it is better to make similar separate incisions on both sides.

Having carried the incision down to the bone, the periosteum is detached from the inner part of the roof of the orbit, and a small opening is chiselled into the sinus at a spot just below the supra-orbital margin, and vertically above the inner canthus. If a sinus exist, however small, it will be found here, but if the bone be thick, and marked *dipl e* be met with, the operation must be stopped. When definite *dipl e* is exposed in this region it is probable that the sinus is absent, and for this reason it is safer to operate with a gouge or chisel than with a trephine. Another advantage in opening the sinus at the spot above indicated is that the sinuses often overlap to a large extent, and if the anterior wall be chosen the sinus on the opposite side may be opened (see Fig. 12).

A probe is passed in to ascertain the extent of the sinus, and the opening enlarged sufficiently to enable its interior to be examined. If no pus be found, the wound is closed: the operation having been done aseptically no trouble should ensue. In such cases the ethmoidal cells must be at fault, and they might of course be easily reached by extending the operation, but this seems bad practice seeing that the frontal sinus would thereby be certainly infected. The ethmoidal cells are best dealt with intra-nasally

as above recommended (Chap. XX.). If pus be found, the skin incision should be extended downwards to the level of the inner canthus, and outwards to the outer end of the sinus, as determined by the probe. The periosteum is detached downwards and backwards from the inferior wall of the sinus, in doing which the pulley of the superior oblique muscle may be displaced. This rarely gives rise to trouble; temporary diplopia may occur after the operation, but it is probably more often due to effusion into the orbit than to interference with the muscle. The pulley soon acquires a fresh attachment, and complete recovery ensues.

A large opening is now made into the sinus through the inferior wall, and the inner wall of the orbit is freely cut away with forceps or chisel to give access to the infundibulum. If the sinus contain polypi, they should be removed, and the posterior wall carefully examined for caries or perforation. In a case reported by Lothrop the patient died from cerebral abscess three months after operation, and a perforation which was probably in existence, but had been overlooked at the time of the operation, was found in the outer part of the posterior wall.

It must now be decided whether the sinus should be obliterated, or whether simple drainage should be adopted. Obliteration is more certain,



FIG. 115.—TILLEY'S BURR FOR ENLARGING INFUNDIBULUM.

and usually results in a speedy cure. It is always to be preferred if the sinus be not too large, as the subsequent deformity will then be slight. It is especially desirable when there is caries of the bony walls, and should always be performed when the posterior wall is deficient, or when brain symptoms are present.

To **obliterate the cavity** the entire anterior and inferior walls must be removed. This is most easily effected with a strong pair of bone forceps, aided, if necessary, with gouge or chisel. A probe is then passed down the infundibulum to serve as a guide, and all the bone between the lower part of the wound and the probe, and the whole of the nasal portion of the floor of the sinus is cut away. The anterior ethmoidal cells and the infundibulum are freely opened up and curetted. The curette may be used through the nose, guided by a finger in the wound. The mucous membrane lining the sinus is removed, care being taken to empty every recess and crevice. A rubber drainage tube is passed down the infundibulum and brought out at the anterior nares, the upper end of the tube being stitched to the inner angle of the wound. The wound is cleansed, the skin and periosteum sutured with a non-absorbent material, and allowed to fall back into contact with the posterior wall of the sinus. A dressing is applied, the most suitable being a pad of boracic lint kept wet with a solution of

boracic acid, and frequently changed. This dressing may be iced for the first 24 hours; the cold is comforting to the patient, while it tends to prevent swelling and extravasation into the orbit.

After-treatment. Considerable oedema of the upper eyelid often follows the operation and the patient may have a black eye for a few days. The wound usually heals by first intention, and the sutures may be removed from the fifth to seventh day. The sinus should be syringed daily with weak boracic lotion, or peroxide of hydrogen may occasionally be used. The tube should have a long loop of silk attached to its upper end: it can then be withdrawn through the nose, and after the sinus has been syringed, replaced by pulling it up with the silk loop. The tube should be retained five to ten days, after which it may be replaced by a curved silver tube (see Fig. 116). This tube is retained for two or three weeks, until the wound has soundly healed and all discharge has ceased.

The **results** of this operation are good. The sinus being obliterated, a cure of the suppuration is invariably obtained. Turner finds sixty-seven



FIG. 116.—AUTHOR'S CANNULA FOR FRONTAL SINUS.

cases on record, all but one of which were cured. The resultant deformity with small sinuses is very slight and even with large sinuses is usually less than would be expected.

Killian's Operation. If a large sinus is present and obliteration is indicated, present day opinion, with which I entirely agree, would probably favour Killian's method. The operation is a little more difficult and requires more time than that above described, but the result is well worth the extra trouble. The depression, especially when a deep sinus is present, is much diminished; the results as far as can be at present stated seem equally certain, but the healing is slower. A cavity is left between the supra-orbital margin and the posterior wall of the sinus which requires time to become obliterated by granulation tissue. Killian makes a skin incision from the outer end of the orbit along the line of eyebrow, curving gradually downwards at its inner end to terminate just below the inner canthus. Having bared the periosteum he makes two incisions through it, one just above, the other below, the supra-orbital margin, and detaches the periosteum from the anterior and inferior walls of the sinus, leaving it attached to the small intervening bridge of bone. The anterior and inferior walls of the sinus, with the exception of the bridge of bone forming the supra-orbital ridge, are then removed, the entire lining membrane of the sinus is

scraped away, and the infundibulum opened up as above described. It is necessary to be very careful to remove all the lining membrane, especially from any cell or recess at the extreme outer angle of the sinus, a part insufficiently exposed by this method.

The drainage and after-treatment must be conducted on the lines above indicated. In addition to the tube I prefer to insert a strip of gauze into

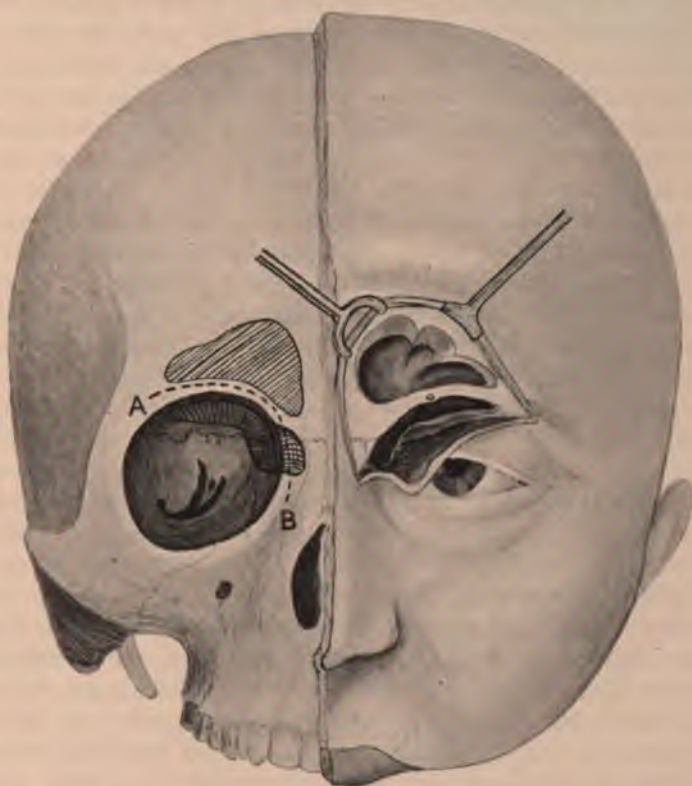


FIG. 117.—KILLIAN'S OPERATION ON THE FRONTAL SINUS (SEMI-DIAGRAMMATIC). On the right side the bones are shown. The incision is represented by the dotted line AB. The shaded parts represent the bone to be removed. On the left side, the soft parts and bones are shown as in the actual operation when completed.

the sinus, which can be changed daily and gradually diminished in amount as the sinus becomes obliterated.

Without Obliteration. If, on the other hand, it be decided not to attempt obliteration of the sinus, when a sufficiently free opening into it has been made, the cavity should be thoroughly cleansed, care being taken to avoid injury to the mucous membrane. Of course, any polypus or other gross lesion should be removed. Many operators advise and presumably practise free curettement of the lining membrane, apparently oblivious of the fact that this can only retard healing; for if the cavity be not obliterated it is necessary that the mucous membrane should return to its

normal healthy condition in order to obtain a cure. A cure will follow if all gross lesions are removed, and the re-accumulation of pus prevented by free drainage; the less the damage inflicted on the mucous membrane, the more rapidly will healing take place.

After cleansing the sinus, the infundibulum must be enlarged and the anterior ethmoidal cells removed as above described. A large rubber drainage tube is passed down the infundibulum into the nose, its upper end being fixed to the edges of the incision; the rest of the wound may be sutured. After four or five days the tube should be changed. A similar tube is attached by a long silk thread to the upper end of the first tube, which is then drawn out through the nose. The sinus is thoroughly syringed out and then the second tube drawn into position by means of the silk thread.

The **after-treatment** consists in withdrawing the tube daily, cleansing the sinus, and replacing the tube. After a fortnight, when the external wound has soundly healed, the tube may be replaced by a suitably curved small silver tube shaped somewhat like a tracheotomy tube, with a flange at its upper end to prevent it slipping into the nose. The tube may be worn without any dressing, and serves to maintain free drainage of the sinus, and to prevent contraction of the enlarged infundibulum. This tube is removed once or twice daily to allow the sinus to be syringed and must be worn for weeks, or even months, until all discharge has ceased, when it may be omitted, and the external opening allowed to close.

This method is based upon sound surgical principles, as it maintains free drainage as long as may be required. In this way the fatalities following the Luc operation, which, as will be shown, result from the lack of provision for free drainage, will be avoided. The results of the operation are fairly good. It is free from danger, but a cure is by no means so certainly or so rapidly obtained as by obliteration. Even when it fails to cure the discharge, the most prominent symptoms may be relieved. If the symptoms persist, obliteration of the sinus can be performed later.

The **Ogston-Luc Operation** has probably been more often practised than any other method. Luc makes a supra-orbital incision, opens the sinus through its anterior wall, cures and cleanses the cavity, enlarges the infundibulum and inserts into it a funnel-shaped tube, the upper end of the tube resting in the frontal sinus, whilst its lower end is brought out at the anterior naris. The distinctive feature of the operation is the immediate closure of the entire external wound, and the reliance upon intra-nasal drainage alone. The sinus is irrigated daily through the tube, which cannot, however, be retained for more than five to ten days on account of the irritation to which it gives rise. The tube is then withdrawn from the nostril. Instead of a funnel-shaped tube, an ordinary rubber drainage tube may be used, the upper end being fixed in the sinus by one of the sutures uniting the skin wound. Many authors advise that no tube at all should be used, relying solely on the large opening made into the

nose.¹ This method is so far successful in that it drains the cavity for a time and allows the external wound to heal by first intention. This, and the absence of external deformity, are the great merits claimed for it, but the ultimate results are usually unsatisfactory.

Results. Of eleven cases in which I operated by this method, in four headache and pain were relieved and the discharge diminished. In five cases there was no relief at all, and in two of these there was considerable trouble with the wound. The pus re-formed in the sinus, burst open the wound, which discharged for weeks, necessitating the wearing of a small tube, for as soon as the wound was allowed to close tenderness and swelling reappeared. Finally, two cases ended fatally from acute septic diploëtis of the frontal bone. In three cases I re-opened the cavity for re-accumulation of pus some time after the original operation, and found that the infundibulum was blocked by polypi and exuberant granulation tissue, whilst extensive granulations had sprung up at the seat of the external wound, and had nearly cut off the outer part of the sinus from its communication with the nose. The remaining portion of the cavity was filled with pus under tension, and its mucous membrane was granulating. In one case the posterior wall of the sinus was carious and the dura mater exposed. These results are just what might be expected. The conditions described are obviously dangerous and sufficient in themselves to cause the abandonment of this method.

Lermoyez has performed the operation seventeen times, nine cases healed by first intention and eight relapsed: two of the latter died. Luc admits that many of his cases were unsuccessful. Logan Turner reports six cures in ten operations, and from a careful study of reported results finds that there have been 31 successes in 55 cases.

Mortality. Numerous fatalities have been reported, and many others have probably occurred. Luc² has had two fatal cases, in one of which four unsuccessful operations had been performed. Others have been reported by Lermoyez,³ Tilley,³ Rudloff,⁴ Thomson,⁵ Turner, etc., and three have occurred in my own practice. Logan Turner has collected 24 cases in which death followed operation on the frontal sinus, sixteen obtained from published records, eight from private information. Seventeen of these followed the Ogston-Luc operation, a very high proportion.

All the fatal cases are strikingly similar; although some died after a short illness, others after prolonged suffering. One case may be quoted as an example. A girl, aged 21, in good general health, had the right frontal sinus opened through the anterior wall, the anterior ethmoidal region freely opened up, and a drainage tube inserted as Luc recommends, and

¹ See Hill, *Journ. of Laryngol.*, 1898, xiv. p. 300.

² *Journ. of Laryngol.*, 1899, xiv. p. 473 and 1902, xvii. p. 642.

³ *Journ. of Laryngol.*, 1899, xiv. p. 475 and 1903, xviii. p. 584.

⁴ *Journ. of Laryngol.*, 1899, xiv. p. 481.

⁵ *Lancet*, 1905, ii. August 12th.

retained for seven days. The wound healed by first intention, but on the fifteenth day partially re-opened and some pus escaped. A few days later a puffy swelling appeared over the supra-orbital region, and the temperature rose to 99° - 100° F. The patient complained of severe headache, but otherwise was not actually ill. An incision over the eye-brow gave exit to a very little pus from beneath the periosteum: the surface of the bone was bare and rough. Very gradually the patient's condition became worse, the temperature rising a little higher, and swelling after swelling appearing in different parts of the frontal region. Free incisions were made, the greatly thickened periosteum was excised, and large necrotic pieces of the outer



FIG. 113.—OSTEOMYELITIS OF SKULL RESULTING FROM SEPTIC INFECTION OF THE DIPLÔE AFTER OPERATION ON THE FRONTAL SINUS. 1. The left frontal sinus. 2. Perforation of skull exposing longitudinal sinus. 3. Necrotic portions of outer table of skull. (From a specimen kindly lent by Dr. Herbert Tilley.)

plate of the frontal bone removed. Later a transverse incision was made right across the vertex, almost from ear to ear, and the whole outer plate of the frontal bone cut away. The diplôe was covered with granulations, and the bone was in parts necrosed. The disease slowly spread to the parietal and temporal bones, suppuration in the middle ear and mastoid antrum occurred, and the patient ultimately died of cerebellar abscess and meningitis nine months after the original operation. Other identical cases have been reported, although some ran a more rapid course. In other fatal cases, acute meningitis has supervened.¹ Only one case is known to me

¹ Boley, *Journ. of Laryngol.*, 1897, xii. p. 78.

in which this osteomyelitis or diplöitis of the frontal bone has been followed by recovery.¹ A study of these cases shows the method and cause of the infection, and the means of preventing it. The infection commenced in the anterior wall of the sinus, pus having re-formed there under tension, which was sometimes sufficient to burst open the operation wound. This is confirmed by the results found on re-opening the sinuses, which showed that however large an opening is made into the nose, it quickly becomes obliterated by oedema and granulations, and does not provide efficient drainage. The pus infects the recently-wounded diplöic veins which exist in the anterior wall of the sinus. Thus every operation on the frontal sinus, to be safe, must provide free and prolonged drainage. The above considerations, and the large number of fatal results, which would probably form no small percentage if all were published, prove conclusively that the method of drainage provided in Luc's operation is not efficient, and that the operation is neither safe nor curative. Luc himself admits that the operation is suitable only in certain cases, namely, when the sinus is small, the ethmoid free from disease, and the suppuration recent. Turner apparently agrees with this. But when the sinus is small, there is no object in resorting to this method, as obliteration leaves no deformity.

Operation with External Drainage only. The methods of treating the sinus by opening it and providing external drainage alone may be briefly discussed. Occasionally simple opening and cleansing of the cavity may result in success, the infundibulum resuming its functions, and then external drainage for a short period is all that is required. On the other hand, I have had patients who maintained external drainage by wearing tubes for years without any improvement, and have seen similar cases in the practice of others. Walker Downie, who has advocated this method, makes a large opening into the anterior wall of the sinus, cleanses the cavity, and then packs it with gauze. The end of the strip of gauze is brought out at a small opening made near the inner canthus, and the original wound completely closed. Although he has reported some successful cases, the principle is a bad one. If obliteration be aimed at, the methods described above are better; if the mucous membrane be left it will continue to secrete, and therefore in the majority of cases external drainage will not succeed unless a permanent fistula is established, a most undesirable result.

Conclusions. The treatment of chronic suppuration in the frontal sinus may be summarised as follows: Intra-nasal treatment should always be tried unless urgent symptoms are present; (a) free access to the lower part of the infundibulum should be obtained by removing the anterior end of the middle turbinate, and by breaking down the fronto-ethmoidal cells; (b) nasal irrigation should be carried out for a few weeks, and supplemented in favourable cases by washing out the sinus itself through its natural opening; but (c) no attempt should ever be made forcibly to enter the

¹ Rogers (ref.), *Journ. of Laryngol.*, 1900, xv. p. 443.

sinus from the nose. When serious symptoms are present, and the above treatment has failed, the frontal sinus should be opened externally, and obliterated (*a*) when it is small; (*b*) when the affection is chronic or the bony walls are diseased; (*c*) when cerebral symptoms are present. In other cases, having opened the sinus, a large communication should be made with the nose, and free drainage, nasal and external, maintained until all suppuration has ceased. Operations providing external drainage only are inefficient. Operations allowing of intranasal drainage for a limited time only are both dangerous and inefficient.

The amount of deformity following an external operation varies much. There is usually very little after simple drainage of a sinus, unless the tube has been long retained, when a small, depressed, adherent scar may result. This can be easily remedied by simple excision of the scar. The deformity, after obliteration of a small sinus, may be scarcely noticeable; but when a large sinus, and especially one that is deep in an antero-posterior direction, has been obliterated, a considerable depression may result. This may be partly remedied by excising the scar, and partly by subsequent paraffin injections. Before injecting the paraffin, the scar should be undercut with a narrow-bladed knife, and a cavity formed to receive the wax. Paraffin melting at 115° F. may be used, and must be very carefully injected with full antiseptic precautions. Very little should be injected at a time, and especial care should be taken to prevent the paraffin spreading into the surrounding tissues. Petersen claims good results from this method. Probably Killian's operation may render this process unnecessary in future.

The following works may be consulted:

- OGSTON. *Medical Chronicle*, 1884, i. p. 235.
 JANSEN. *Archiv für Laryngol.*, 1894, i. p. 135.
 KUHNT. *Die entzündlichen Erkrankungen der Stirnhohlen*. Wiesb., 1895.
 LUC. *La Semaine Médicale*, 1894, xiv. p. 277, and *Journ. of Laryngol.*, 1895, ix. p. 558.
 TILLEY. *Lancet*, 1896, ii. p. 866, and 1899, ii. p. 534.
 SCHECH. *Archiv für Laryngol.*, 1895, iii. p. 165.
 LACK. *Journ. of Laryngol.*, 1896, xi. p. 88.
 STEWART. *Lancet*, 1898, ii. p. 1547.
 BARTH. *Archiv für klin. Chirurg.*, 1898, lvii. p. 756.
 LUC. *Archiv Internat. de Laryngol.*, 1897, xxiii. p. 476, and *Annales des Mal. de l'Oreille*, 1902, xxviii. pp. 497-527.
 PHOTIADES. *Annales des Mal. de l'Oreille, etc.*, 1897, xxiii. pp. 476-484.
 RÖPKE. *Archiv für Laryngol.*, 1898, viii. p. 308.
 SPIESS. *Archiv für Laryngol.*, 1899, ix. p. 285.
 SPIESS. *Journ. of Laryngol.*, 1899, xiv. p. 571.
 KILLIAN. *Archiv für Laryngol.*, 1902, xiii. p. 59.
 KRAUSS. *Archiv für Laryngol.*, 1902, xiii. p. 28.
 LACK. *Edinb. Med. Journ.*, 1902, xi. p. 537.
 CHARTERS SYMONDS. *Journ. of Laryngol.*, 1899, xiv. p. 469.
 LERMOYEZ. *Brit. Med. Journ.*, 1902, ii. p. 579, and *Annales des Mal. de l'Oreille, etc.*, 1902, xxviii. pp. 398-407.

- TILLEY. Brit. Med. Journ., 1902, ii. p. 582.
MOURE. Journ. of Laryngol., 1903, xviii. p. 298.
MAYO COLLIER. Journ. of Laryngol., 1903, xviii. p. 635.
PETERSEN. Münch. med. Woch., 1903, l. p. 449.
LOGAN TURNER. Edinb. Med. Journ., 1905, p. 239.
MILLIGAN. Brit. Med. Journ., 1905, i. p. 239.
GIBSON. Amer. Journ. Med. Science, 1903.

CHAPTER XXII.

TREATMENT OF SUPPURATION IN THE SPHENOIDAL SINUS.

THE sphenoidal sinus was for a long time considered inaccessible, but modern methods have brought it well within the scope of surgical interference; it is in fact one of the easiest sinuses to treat successfully. The method of treatment depends to a large extent upon the associated conditions.

Irrigation through the Natural Opening. When the nasal passages, including the cleft between the middle turbinate and the septum, are unduly wide, as is not uncommon in atrophic rhinitis, it may be possible to see the ostium of the sphenoidal sinus by anterior rhinoscopy, but generally it is necessary to remove the middle turbinate in order to bring this opening into view. When the ostium can be seen a cannula should be passed through it and the sinus washed out. If on inspection and probing no bone disease can be detected in the sinus walls, daily irrigation with a mild antiseptic, such as boracic acid solution, may be continued for a time. If this treatment does not effect a cure, or greatly diminish the discharge within a few days, stronger antiseptics may be applied. The best of these is a ten to twenty volume solution of hydrogen peroxide, or a two to five per cent. solution of sulphate of copper. A few drops of either solution may be injected into the sinus after it has been cleansed, left for a few seconds, and then thoroughly washed away with boracic lotion. Sulphate of copper is warmly recommended by Hajek, and as it is occasionally successful in cases of chronic antral suppuration, it seems well worthy of a trial.

Intranasal Operation. If treatment by irrigation fail, if the opening of the sinus be extremely small, or if caries of the sinus walls or oedema of the overlying mucous membrane be detected, it is better to operate. Bearing in mind the important anatomical relationships of the sphenoidal sinus, it is obvious that any operation must be carried out with extreme care. The best plan is to enlarge the natural opening with Hajek's hook or chisel. The anterior wall of the sphenoid is thoroughly anaesthetised and rendered bloodless with cocaine and suprarenal solution. In very

sensitive patients a general anaesthetic may be given, but as a rule it is unnecessary. The hook is passed through the natural opening of the sinus, and then its anterior wall is broken down by traction; the loose pieces may be clipped away with Grünwald's forceps. When the opening has been sufficiently enlarged, the cutting forceps shown in Fig. 119 may be used with great advantage. It is important to remove as much of the anterior wall as possible in order to obtain free drainage of the sinus, and because the opening shows some tendency to contract. Hajek and Onodi have drawn special attention to the fact that the anterior wall of the sinus consists of a nasal, usually narrower portion, an ethmoidal, usually broader portion, and occasionally of a third or maxillary portion (see Figs. 18, 120). Hajek strongly advises that the posterior ethmoidal cells should be opened before



FIG. 119.—AUTHOR'S CUTTING FORCEPS FOR SPHENOIDAL SINUS.

operating on the sphenoidal sinus, as in this way better access can be obtained to the latter and its whole anterior wall removed. Moreover the posterior ethmoidal cells are usually simultaneously affected. This advice seems sound, and I have recently adopted the method.

If the sinus contains polypi or granulations they should be cut away with forceps or gently curetted. It is best not to attempt removal of the entire lining membrane even when there is extensive disease. Healing usually takes place when free drainage has been established, and it is better not to lay bare the bone. Moreover great care must be exercised in curetting, as injury of the roof or lateral walls of the sinus may entail the most serious consequences, and even prove fatal. In more than one case the cavernous sinus has been wounded, and has given rise to alarming haemorrhage.¹

The **after-treatment** consists in irrigating the sinus daily with mild anti-septic lotions, and, if necessary, stronger solutions may be applied as above

¹ MacDonald, *Diseases of the Nose*, London, 1892, p. 260; also Tilley, *Journ. of Laryngol.*, 1903, xviii. p. 584.

directed. An intelligent patient may sometimes be taught to carry out the irrigations for himself. At intervals of not less than twice a week the cavity should be washed out, dried with mops of wool on a probe, and carefully inspected until the edges of the opening have healed and there is no danger of further contraction. If there are signs of contraction Hajek advises that the edges should be cauterized on the tenth day, and again later if necessary.

The results of these operations as far as my experience goes are good. The opening remains permanent, and the interior of the sinus soon becomes dry. A cure is usually obtained in two to eight weeks.

Operation with Curette. Occasionally the sphenoidal sinus may be opened in another way. Thus it once happened that in curetting the



FIG. 120.—HORIZONTAL SECTION OF THE RIGHT NASAL FOSSA. Showing the relations of the anterior wall of the sphenoidal sinus. 1. Nasal cavity; 2. Posterior ethmoidal cells; 3. Antrum; 4. Sphenoidal sinus.

posterior ethmoidal region for polypi and suppuration the finger, forced well up into the post-nasal space, detected carious bone on the anterior surface of the sphenoid. The softened bone gave way on pressure, and the tip of the finger passed into a large cavity. From its position it was obvious that this cavity must be the sphenoidal sinus: the opening made was therefore enlarged by breaking down the carious anterior wall with the curette, guided by the finger. It may be noted that in this and in another similar case semi-gangrenous polypi associated with an intensely foetid discharge, were present in the nose, and that these polypi rapidly recurred until the curettement had been carried out. The large opening that was made remained permanent, and no after-treatment beyond simple irrigation of the nose was necessary. Three cases treated in this way were all cured,

both as regards the polypi and the suppuration. The method, however, is only applicable when there is extensive caries of the anterior wall of the sinus, and requires general anaesthesia.

Of **other methods of operation** I have had no personal experience, and must therefore speak more briefly. It has been recommended that when the ostium is invisible, the anterior wall of the sinus should be bored through from the front with an electric drill or burr, or opened with special forceps. Watson Williams has designed a special modification of Grünwald's forceps for this purpose. These methods seem dangerous owing to the great variability in the size of the sphenoidal sinus. I do not think it could ever be justifiable to bore into the anterior surface of the sphenoid in the hope of reaching the sinus unless the position and extent of the latter had been carefully ascertained beforehand by passing a hooked probe into it. Moreover I fail to see how a certain diagnosis can be made except by bringing the ostium of the sinus into direct view by anterior rhinoscopy. If the ostium can be seen the method above recommended can be adopted and offers obvious advantages in its ease and precision.

External Operation. It has also been recommended that the sphenoidal sinus should be reached by an external operation such as I have described for exposure of the ethmoidal cells (see page 333). A curved incision is made round the inner side of the orbit, the ethmoidal cells exposed and cut away one by one until the sphenoidal sinus is reached. This operation is not difficult upon the cadaver, but in the living subject the amount of bleeding that ensues, the small diameter and the great depth of the wound, make it extremely difficult and tedious. The risk of such a procedure seems unjustifiable when there is an alternative, simple, safe and rapid method. Even in acute disease the operation through the anterior nares could probably be carried out with greater speed and precision.

Jansen's Operation. Lastly, Jansen has recommended that the sphenoidal sinus should be opened through the antrum. Occasionally (see Fig. 120) the sphenoidal sinus comes into close relationship with the maxillary antrum and is separated from it by only a thin plate of bone. In these circumstances Jansen's operation may be easily performed. Onodi examined twenty-five skulls with special reference to this point, and found that the operation was anatomically possible in only three. Under normal conditions the operator would either first enter the nasal cavity and then the sphenoidal sinus, or he would damage the vessels and nerves which pass through the sphenopalatine foramen. Onodi considers the ordinary nasal route the only safe way to the sphenoidal sinus. It is difficult to see how Jansen's operation could give such a clear view of the field of operation as the methods above described, but it may be a rapid and efficient method of dealing with multiple sinus suppurations, as almost all the sinuses can be attacked at the same sitting. It may also be justified when the nasal fossae are extremely narrow.

To sum up, the sphenoidal sinus may occasionally be opened, whilst operating on the posterior ethmoidal region, by the curette guided by the finger in the post-nasal space, but with this exception, the best plan is to bring the ostium of the sinus into view, and accurately and precisely to remove its anterior wall. This can be done without appreciable risk under cocaine anaesthesia, and with care in the after-treatment a successful result is extremely probable.

The following works may be consulted :

- MOURE. *Revue hebd. de Laryngol., etc.*, 1893, xix. p. 817.
LAPERSONNE. (Ref.) *Journ. of Laryngol.*, 1900, xv. p. 49.
HALSTEAD. *Archives of Otol.*, xxx. p. 222.
FURET. *Archiv. internat. de Laryngol., etc.*, 1901, xiv. pp. 1, 181.
GRÜNWARD, LACK, etc. *Brit. Med. Assoc. Meeting*, August, 1902 ; reported *Journ. of Laryngol.*, 1902, xvii. p. 598.
M'KEOWN. *Lancet*, 1902, ii. p. 290.
WRIGHT. *Annals of Otol., Rhin. and Laryngol.*, 1902, Feb.
BERENS. *Journ. of Laryngol.*, 1904, xix. p. 660, and *Trans. Amer. Laryngol. Soc.*, 1904, p. 89.
HAJEK. *Archiv für Laryngol.*, 1904, xvi. p. 105.
GORIS. *La Presse Oto-laryngol.*, Belge, 1903, ii. p. 143.
HINKEL. *Trans. Amer. Laryngol. Association*, 1902 ; reported in *Laryngoscope*, 1902, xii. p. 736.
HOLBROOK CURTIS. *Trans. Amer. Laryngol. Soc.*, 1904, p. 103.

CHAPTER XXIII.

MUCOCELES OF THE ACCESSORY SINUSES OF THE NOSE.

MUCOCELES or bony cysts of the accessory sinuses are by no means rare, although, to judge from the scanty records in medical literature, they have hitherto attracted little attention. The affection is common in connection with the middle turbinate and the ethmoidal cells: more rare in the frontal sinus, whilst the occurrence of mucocèles of the sphenoidal sinus and antrum has not yet been placed beyond doubt.

Definition. A mucocèle may be defined as the distension of one of the accessory sinuses of the nose as the result of obstruction of its outlet. The bony cysts in the nose may be classified into three varieties according to their contents. A small number apparently contain nothing but air, the great majority contain mucus or clear fluid and are properly described as mucocèles, while some have muco-purulent or purulent contents. The last are probably the result of infection of a mucocèle by pyogenic organisms.

Etiology. The distension of a cell or sinus usually arises from the pressure of retained secretion as the result of temporary, or more usually of permanent, obstruction of its outlet. The obstruction may result from trauma, as Killian believes, but in all probability it is most often due to nasal catarrh. Mucocèles are most common in connection with the ethmoidal cells, which region is most exposed to catarrhal infection: and the cell most often affected, that in the anterior end of the middle turbinate, is especially vulnerable. The frequency with which mucocèles are associated with nasal polypi points to their having a similar origin. When an acute inflammation of the ethmoidal region occurs, when the periosteum becomes thickened and the overlying mucous membrane oedematous, it is obvious how easily the outlets of the ethmoidal cells can become obstructed. If obstruction occur, the fluid secreted by the lining membrane of the cell will accumulate, and cause slow distension of its cavity. If now pyogenic organisms gain admission, the contents of the cavity will become purulent and the lining mucous membrane will be red, swollen, and granulating, or perhaps changed into a pyogenic membrane. Very rarely it seems probable that the opening of the sinus may be congenitally deficient. Thus, I have had under my care a boy, twelve years of age, with bilateral mucocèle

of the frontal sinuses. There was no other sign of disease in the nose, and no other cells were affected. The bilateral nature of this affection, and the absence of any sign of disease in the ethmoidal region point to a congenital developmental defect rather than to an inflammatory origin. It is very difficult to understand how trauma could ever cause a mucocoele.

Pathology. As already stated, the bony cysts of the nose may contain air, mucus, or pus. The mucus may be clear and yellow; milky or chocolate-coloured; fluid, or containing stringy masses. The cysts which contain air are probably nothing but abnormally large cells. They are lined by normal mucous membrane covered by ciliated epithelium, and the bony wall shows no sign of disease. The inflammatory origin of most mucocoeles is shown by the changes which have occurred in the lining membrane. The epithelium consists of one or two layers of cells, the innermost one of which may be ciliated. Beneath the epithelium is a thickened mucous membrane infiltrated with round cells. The periosteum is usually thickened, and in its deeper layers are large multinucleated cells or osteoclasts, in the neighbourhood of which there is usually evidence of rarefying osteitis. Whilst the bone is undergoing absorption on its inner side, fresh bone is being deposited on the outside. In mucocoeles of the frontal sinus macroscopic evidence of bone changes is usually present. In parts the walls may have given way altogether, and around the edges of the perforation thickened irregular deposits of bone may be felt, the result of hyperplastic periostitis.

MUCOCELES OF THE ETHMOID.

Bony Cysts of the Middle Turbinate. As already stated, a cell containing air is present in the anterior end of the middle turbinate in about 20 per cent. of skulls, and this cell is very commonly distended. When the cavity contains air only, and the mucous membrane of the middle turbinate is normal, it is probable that even a very large cell is merely a developmental anomaly. They have been regarded as aberrant ethmoidal cells, and may be recognisable in very early life or even in the foetus (Kikuski). A cyst containing mucus or a mucoid fluid arises when the outlet of the cell has become obstructed as the result of nasal catarrh: the fluid normally secreted by the mucous membrane accumulates in the cavity and distends it. This is the most common cyst of the middle turbinate and is a true mucocoele. Very rarely cysts in this region have been found to contain pus or muco-pus: this means that subsequent pyogenic infection has taken place.

Symptoms. Cysts of the middle turbinate vary greatly in size; they may give rise to slight enlargement of the anterior end of the bone, or form a tumour completely filling the middle, and even extending into the inferior, meatus. A large cyst may cause considerable pressure on the septum and push it over to the opposite side. The patient complains

of slowly progressive, unilateral, nasal obstruction: after a time, owing to the deflection of the septum, the opposite nostril may also become obstructed. Anosmia, alteration of voice, mouth breathing, chronic nasal catarrh, asthma and other remote or reflex results of nasal obstruction are frequently present. Another common symptom is pain. The patient may complain of dull boring headache, usually confined to the affected side, and most marked in the supra-orbital region. There is often a feeling of tension across the bridge of the nose, and superficial tenderness in the supra-orbital region and over the nasal bone. Attacks of severe neuralgia may occur in any division of the fifth nerve. On examination, a tumour will be seen occupying the middle meatus, and perhaps extending downwards into the inferior meatus. The mucous membrane covering the tumour is usually thickened or hypertrophied and to the naked eye the growth may exactly resemble an ordinary nasal polypus. The diagnosis may be made by examination with the probe, when the bony cyst will be found to be hard and fixed, whilst a polypus is always movable within a certain range. These cysts are very commonly associated with nasal polypi, both being due to the same cause. The diagnosis may also have to be made from a deflected septum, from an osteoma, or from malignant disease of the ethmoidal region. Careful examination with cocaine anaesthesia and the use of the probe will usually remove any doubt.

Mucocele of the Ethmoidal Cells. Other ethmoidal cells may be similarly affected. Thus the large cell forming the bulla ethmoidalis may become distended and form a tumour projecting into the nose exactly resembling and producing the same symptoms as a cyst of the middle turbinate. The differentiation can only be made by removing the cyst, when the normal middle turbinate will come into view. The diagnosis, however, is not of much importance as the treatment in both cases is the same. It is possible that other ethmoidal cells may also be affected, and cause tumours projecting into the nose, but of these I have had no personal experience.

Mucocele Projecting into the Orbit. Logan Turner has collected notes of 15 cases of mucoceles of the ethmoidal region projecting into the orbit. Three cases of this kind have been under my care. The first symptom that attracts the patient's attention is displacement forwards of the eye-ball. As the tumour increases in size, it gradually comes forward, and forms a swelling on the inner and upper wall of the orbit, pushing the eye outwards and downwards; if it attains a large size it may produce optic neuritis and impaired vision from pressure on the optic nerve. The swelling is at first hard and bony, like an exostosis, later it may have a parchment-like feeling, or the bone may entirely give way, and a soft fluctuating swelling result. The slow, painless formation of the tumour is characteristic. On examining the nose nothing abnormal may be found, but in rare cases the tumour may also present in the region of the middle meatus (Baurowicz and Avellis). In a few cases nasal obstruction has

been present, and in others there has been some nasal discharge, possibly from a partial leakage of the contents of the cyst. There is complete absence of pain and tenderness.

The diagnosis must be made from malignant disease, which is usually of more rapid growth, causes much pain, and at an early stage involves the optic nerve, causing optic neuritis and blindness. The diagnosis from exostosis has already been indicated (see page 223).

Treatment. Cysts of the ethmoid projecting into the nose should be treated by **removal with the snare** or cutting forceps. The parts should be thoroughly anaesthetized with cocaine and suprarenal extract, pledgets of wool soaked in the solution being packed all round the tumour. Then the wire loop of a strong snare should be passed round the base of the growth, and the whole mass cut away. Occasionally, when the cyst is very large, it may so fill the nose that there is the greatest difficulty in getting a wire to pass round it. In these circumstances the best plan is to open the cyst with Grünwald's, or other cutting forceps, and to clip away as much of its walls as possible. This will evacuate the contents of the cyst, and allow the walls to collapse; after a few weeks a further attempt may be made with the snare, and will probably prove successful.

If the cyst project into the orbit an **external operation** is usually necessary. Should the cyst also appear in the nose, an attempt may be made to remove a portion of its wall with a snare, or it may be opened with cutting forceps, and the effect upon the orbital tumour watched for a time. I have no personal experience of this method, but a successful case is recorded by Baurowicz. The treatment I have always adopted is to make an incision just below the line of the eyebrow, commencing near the supra-orbital notch, and extending in a curved direction inwards and downwards to just below the inner canthus. The incision is deepened, and the periosteum detached from the inner wall of the orbit. The cyst is then laid open and its contents evacuated. Its walls should be cut away as far as possible, and its interior explored with the finger. By means of a curette working partly through the wound, and partly through the nose under the guidance of a finger in the wound, as large a communication as possible should be broken into the nose, through which a drainage tube is inserted and brought out at the anterior nares. The after-treatment is exactly similar to that after an external operation on the ethmoidal cells for chronic suppuration (see page 333). A good recovery will result if drainage is maintained for a sufficient time, that is, for two to four weeks. The importance of establishing free nasal drainage must be insisted upon: neglect of this precaution was the sole cause of the failure of two operations on a case which subsequently came under my care, and was easily cured.

MUCOCELE OF THE FRONTAL SINUS.

A greatly distended frontal sinus containing air only is a rare occurrence; Turner quotes two examples, one reported by Meyjes and the other by Röpke. In both cases the sinus attained large dimensions; the affection was characterized by painful swelling of the sinus walls. No explanation of this occurrence has been offered.

Mucocele of the Frontal Sinus is rare, although Killian has collected 64 cases from medical literature; only two instances have occurred in my practice. The affection is most common in young adults. Its aetiology and pathology is similar to that of mucocele of the ethmoidal cells. In the majority of cases the infundibular obstruction is probably of inflammatory origin, but when the affection is bilateral, as in one of my cases in which both sinuses attained a huge size at the age of 12, it is probably due to some developmental anomaly. The obstruction may also be due to the pressure upon the infundibulum of a new growth such as an exostosis, examples of which have been recorded by de Santi, Luc, and others. Other cases have been ascribed to trauma.

The **symptoms** are very characteristic. There is a slowly progressive, painless swelling in the region of the frontal sinus, the walls of which yield chiefly at their thinnest part, that is, at the upper and inner angle of the orbit; the anterior wall of the sinus is generally less affected. At first the swelling is hard, but as the distension of the sinus increases the bone becomes thinned and yields with a parchment-like feel on pressure, or in places it may become entirely absorbed, when a soft fluctuating swelling will be present. Most frequently the bone is absent over the part corresponding with the inferior wall of the frontal sinus; occasionally the anterior wall may also disappear, and on opening the sinus it is by no means rare to find the dura mater exposed. Around the edges of the perforation the bone is often irregularly thickened as the result of hyperplastic periostitis. The affection runs an extremely chronic course, the patient frequently does not seek advice until two, four, or even ten years after first noticing the swelling in the orbit. Pain is very unusual. The chief symptoms result from the displacement of the eye. There is at first proptosis; later the eyeball is pushed downwards and outwards, the palpebral fissure appears to be lowered from the swelling of the upper lid, and diplopia is common. Other interference with vision is rare.

The **diagnosis** has to be made from empyema of the frontal sinus, which is practically never associated with distension of the cavity, and from tumour, for instance exostosis or fibro-sarcoma. Malignant disease of the orbit may produce similar symptoms, but even in its early stages it should be suspected by the fact that it gives rise to more pain, increases more rapidly and is more liable to involve the optic nerve and produce blindness. Syphilitic disease of the anterior wall of the sinus may usually be distinguished

with care. A mucocele of an ethmoidal cell may also present at the upper and inner border of the orbit, as already described, and may be very difficult to distinguish from mucocele of the frontal sinus. The diagnosis, however, is of little moment: treatment in either case consists in opening the cavity through an external incision, and when this has been done exploration with the finger will readily determine with which sinus it is connected.

The **treatment** consists in cutting down upon the swelling through an incision running parallel to, and just below the inner half of, the eyebrow, and extending downwards towards the inner canthus. A large opening is made into the sinus through its inferior wall, its contents evacuated, and the cavity explored with the finger. If the sinus be not very large it is best to obliterate it. The entire anterior and inferior walls should be cut away, the mucous membrane lining the sinus thoroughly removed, and then the soft parts sutured and allowed to fall back into contact with the posterior wall. No communication should be made with the nose. The operation should be performed as aseptically as possible. Drainage is probably unnecessary, but a small tube or strip of gauze may be inserted for a few days if deemed advisable. In this way the cavity may easily be obliterated and a cure obtained.

If, on the other hand, as frequently happens, the sinuses are so distended that obliteration is impossible, the best that can be done is to make a free opening into the sinus, to evacuate its contents, and then to make a large communication with the nose in the position of the obstructed infundibulum. The opening should be large enough to admit the finger, and a full-sized drainage tube should be inserted. The mucous membrane lining the sinus should be left intact as far as possible. After a fortnight or so the tube leading into the nose may be replaced by a silver tube (see Fig. 116); this is removed frequently for syringing, and must be worn until it appears certain that the newly made infundibulum will not contract. The treatment may require many months, but the sinuses are frequently so large that no other method is practicable. The importance of making and of maintaining a free communication with the nose has already been insisted upon. Turner reports two cases in which operation failed entirely through neglect of this precaution, and a second operation had to be undertaken. Also, as has already been pointed out when speaking of the treatment of suppuration of the frontal sinus, the less the mucous membrane lining the sinus is injured, the more rapidly a cure will be obtained.

MUCOCELE OF THE ANTRUM.

This affection is extremely rare. Logan Turner, following Zuckerkandl, even doubts if mucocele of this cavity occurs, believing that the cases which have been described as cystic distension of the antrum are always of dental origin. I have, however, met with a few cases which

lead me to doubt this statement. Their importance warrants a brief description.

CASE 1. In a man under my care with nasal polypus, the left antrum was explored by puncture through the inferior meatus of the nose. Immediately on withdrawing the trochar, clear watery fluid commenced to trickle from the cannula; a considerable amount, about two drachms, of this fluid was collected. It was of clear straw colour, and almost solid with albumen. On attempting to syringe through the antrum considerable obstruction was met with; this gave way with a snap, and the fluid commenced to run out through the nose. The evidence here indicates that the fluid was contained within the antrum, the ostium of which was probably obstructed and gave way on syringing. It is possible, however, that a thin-walled cyst might have been present in the antrum, and that this was punctured. There was no sign of distension of the antral walls.

A small number of similar observations are on record. Thus Noltenius gives an account of 37 cases and Krebs has described two, both of which were cured by a single puncture. Alexander believes these symptoms really point to cyst of the antrum. He states that cysts are often present, usually grow from the inner wall of the antrum, and contain a pale, clear, straw-coloured fluid. Casselberry has described two cases associated with recurring nasal polypus, one was bilateral. Wertheim considers the affection frequent, and has found serous fluid in the antrum without a trace of cysts. He regards the affection as true serous disease of the antrum, and believes the fluid is free in the antral cavity. Killian agrees with this opinion. The diagnosis requires to be made by puncture, as the disease gives rise to no definite symptoms. It is probably therefore more common than is suspected.

CASE 2. A boy came under my care for swelling of the left cheek. The inner wall of the antrum was bulging into the nose, especially in the middle meatus: the upper wall was bulging into the orbit and the left eye was somewhat raised, there was slight swelling in the region of the canine fossa, the alveolar border and palate were normal. The cheek was bright on transillumination. The situation of the swelling pointed to disease in the antrum, the weakest walls of which, the inner and upper, had yielded the most. Cysts of dental origin, although they may protrude into the antrum, never distend it sufficiently to cause bulging of its upper wall, and they cause most swelling in the canine fossa and in the alveolus and palate. On opening the antrum it was found to contain clear mucoid fluid and several large mucous polypi exactly similar to those met with in the nose.

CASE 3. A girl with nasal obstruction and pain over the left cheek. The nasal obstruction was found to be due to a large tumour springing from the ethmoidal region, probably a slowly growing sarcoma, which completely filled the left nasal fossa. The left cheek was dark on transillumination, and the antrum was found to contain a considerable quantity of

mucus, which escaped apparently under pressure as soon as the cavity had been perforated through the alveolar margin. Removal of the tumour through the nose and a single washing through the antrum effected a cure of the antral condition.

CASE 4. A man with sarcoma involving the inferior turbinate and outer wall of the nose. Rouge's operation was performed, the antrum freely laid open, and its whole inner wall cut away. The antral cavity was found to be distended with mucous fluid, the ostium being blocked with the growth.

CASE 5. A man complaining of severe neuralgia of ten days' duration. The pain affected the right infra-orbital region, the upper teeth, and spread over the malar bone to the top of the head; the corresponding nostril was partially obstructed. There was deep tenderness on pressure over the antrum, but no distension of the cavity except on its inner wall. On transillumination the cheek was dark. The antrum was punctured, but it was impossible to syringe through the cavity. Repeated attempts at syringing being unsuccessful, a large opening was made into the antrum through the inferior meatus, a large polypus was brought away together with thick mucus and blood clot, and all symptoms immediately disappeared. The subsequent washings were clear until ten days later, when there was a sudden snap, and a collection of straw-coloured mucus came away, obviously from rupture of a cyst. There seems little doubt that the whole antral cavity was originally distended with mucus, the outlet into the nose being obstructed by polypi or cystic degeneration of the antral mucous membrane. These and other similar cases appear to demonstrate, what indeed one would expect, that the ostium of the maxillary sinus can become obstructed by the same processes which cause obstruction of the outlets of other accessory sinuses, and when this occurs the normal secretion accumulates and distension of the antrum results.

As already stated, Turner denies the existence of this affection. Killian, however, appears to accept the occurrence of distension of the antrum, and supports his opinion on one of Zuckerkandl's post-mortem observations. The examination presented the following appearances. The outer wall of the middle meatus bulged into the nose; there was no ostium maxillare visible; the antrum contained a large quantity of thick pus, its lining membrane was swollen, and the mucous glands showed evidence of cystic degeneration. Dmochowski has described a still more definite case. In an autopsy on a young woman, he found the left ostium maxillare obliterated; the antrum contained thirty cubic centimetres of a transparent yellow fluid, which completely filled the cavity. The walls of the sinus were so thin that they could be indented by slight pressure. The sinus also contained a pedunculated mucous polypus the size of a hazel nut. Microscopic examination of the lining membrane of the antrum showed that the epithelium had disappeared, while the mucosa consisted of a thin layer of compact fibrous tissue. This case is probably similar to one I have already described. The probable cause in both cases was catarrhal inflammation of the antrum

and nose, in consequence of which the ostium maxillare became obliterated. The almost complete disappearance of the ciliated epithelium in Dmochowski's case was probably due to the pressure of the fluid, which also caused atrophy of the mucous glands and thinning and distension of the antral walls.

Diagnosis. The diagnosis has to be made from distension of the upper jaw by cysts arising in connection with the teeth. The latter cause swelling in the region of the canine fossa and expansion of the alveolus, but never bulging of the upper or inner wall of the antrum. Suppuration of the maxillary antrum never gives rise to slowly progressive distension of its walls. Malignant disease may be more difficult to distinguish. The occurrence of frequent, lancinating pain, the bulging of the antrum into the cheek or in some other unusual situation, oedema of the lower eyelid, obstruction of the lachrymal duct, the occurrence of growth in the nose, and the age of the patient, would help to clear up the diagnosis. In mucocele the antrum may be translucent, whilst a solid tumour would certainly cause darkening.

Treatment. In two of my cases puncture and irrigation of the antrum on a single occasion were sufficient to effect a cure. This treatment has sufficed in the great majority of those cases described as serous disease, or hydrops of the antrum. When there was bulging of the antral walls it was necessary to make a large opening from the antrum into the inferior meatus, and in other cases the associated disease of the nose required still more extensive and radical measures. Such cases must be treated according to the conditions present; no general rules can be laid down.

Mucocele of the Sphenoidal Sinus. No example of distension or mucocele of the sphenoidal sinus has, so far as I am aware, been placed on record. nor have I met with one. It is quite probable that they occur, but from the inaccessibility of this cavity, have hitherto been overlooked.

The following articles may be consulted:

LOGAN TURNER. (*A contribution to the pathology of "bone cysts" in the accessory sinuses of the nose.*) Edin. Med. Jour., 1903, lvi. pp. 299, 405, 517; 1904, lvii. p. 47. *Gives full references.*

KILLIAN. Heymann's Handbuch der Rhinol. u. Laryngol., Band iii. Wien, 1899.

Ethmoidal.

STIEDA. Archiv für Laryngol., 1895, iii. p. 359.

LOTHROP. Annals of Surgery, 1898, xxviii. pp. 611, 747.

MANN. Münch. med. Woch., 1901, xlviii. p. 1154.

HARMER. Archiv für Laryngol., 1902, xiii. p. 163.

KIKUSKI. Archiv für Laryngol., 1903, xiv. p. 306.

ONODI. Archiv für Laryngol., 1904, xv. p. 307.

ONODI. Archiv für Laryngol., 1905, xvii. p. 415.

Frontal Sinus.

- CRESSWELL BABER. *Journ. of Laryngol.*, 1897, xii. p. 47.
 BOND. *Journ. of Laryngol.*, 1897, xii. p. 248.
 DE SANTI. *Proc. Laryngol. Soc. of Lond.*, 1898, v. p. 69.
 MEYJES. *Monatschr. für Ohrenheilk.*, 1898, xxxii. p. 22.
 RÖPKE. *Zeitschr. für Ohrenheilk.*, xlix. p. 2.
 LUC. *Annales des Mal. de l'Oreille, etc.*, 1899, April.
 LUC. *Archiv. internat. de Laryngol.*, 1901, xiv. pp. 25, 26.

Antrum.

- DMOCHOWSKI. *Centralb. für Allg. Pathol.*, 1895, vi. p. 177, and *Archiv für Laryngol.*, 1895, iii. p. 255.
 NOLTENIUS. *Monatschr. für Ohrenheilk.*, 1896, xxx. pp. 447-452.
 KREBS. *Archiv für Laryngol.*, 1896, iv. p. 424.
 ALEXANDER. *Archiv für Laryngol.*, 1897, vi. p. 116.
 WERTHEIM. *Archiv für Laryngol.*, 1900, xi. p. 228.
 CASSELBERRY. *Journ. of Laryngol.*, 1901, xvi. p. 456.
 LENNOX BROWNE. *Journ. of Laryngol.*, 1901, xvi. p. 539.
 KUNERT. *Archiv für Laryngol.*, 1898, vii. p. 34.

Dental Cysts Projecting into Nose.

- GERBER. *Archiv für Laryngol.*, 1904, xvi. p. 502.
 JACQUES AND MICHEL. *Journ. of Laryngol.*, 1900, xv. p. 440.
 BAYER. *La Presse Oto-Laryngologique*, 1904, iii. p. 367.
 BROWN KELLY. *Journ. of Laryngol.*, 1898, xiii. p. 272. (Gives full bibliography.)

CHAPTER XXIV.

AFFECTIONS OF THE POST-NASAL SPACE.

POST-NASAL CATARRH.

POST-NASAL catarrh is a common affection characterized by the "hawking up" of mucus from the back of the throat. It is a symptom of many nasal diseases: in all forms of chronic rhinitis there is more or less associated catarrh of the naso-pharynx, besides which much of the nasal discharge flows backwards through the posterior nares into the throat. The catarrh may be associated with general congestion of the mucous membrane of the naso-pharynx, or with swelling or hypertrophy of the lymphoid tissues. In children the latter condition means adenoids, in adults the inflammation is often confined to strands of lymphoid tissue, which run downwards from near the median line towards the sides of the pharynx, and end behind the posterior pillars of the fauces. Inflammatory swelling of these bands is termed hypertrophic lateral pharyngitis. In rhinitis sicca and in ozaena the dry, unwarmed, unpurified air enters the post-nasal space and causes a dry catarrh, or there may be a direct extension of the disease. Occasionally post-nasal catarrh may be a true adenitis, the lymphoid tissue being studded with small white caseous masses of exudation projecting from the gland follicles.

Symptoms. The chief symptom is discharge falling down into the throat, clinging round the back of the pharynx, and exciting a constant desire to hawk and spit. This hawking is most common in the morning, the secretion having accumulated during sleep, and the efforts to dislodge it may bring on retching and vomiting. The voice is altered, being thick and 'nasal' in character: the throat aches if the voice be much used. There is often catarrh of the neighbouring organs, the Eustachian tubes and middle ear, the pharynx and larynx. When associated with rhinitis sicca the secretion is apt to take the form of adherent mucous or mucopurulent crusts, the detachment of which may be associated with slight bleeding. The patient is often alarmed by discovering minute, reddish-black specks of blood in his expectoration. On examination the roof of the post-nasal space may be found to be covered with dry crusts, which may collect more especially in one of the recesses or furrows normally

existing in Luschka's tonsil. This appearance was specially described by Tornwaldt, hence it has been termed Tornwaldt's disease.

Prognosis. The affection may be acute or chronic: the cure to a large extent depends on the possibility of removing the nasal disease. In the acute cases recovery soon takes place; chronic catarrh is very intractable, and when associated with dry or atrophic rhinitis, it is almost incurable. In hypertrophic rhinitis, and especially hypertrophy of the posterior ends of the inferior turbinates, much can be done by operation. When the seat of the disease is limited to the lymphoid tissue a cure is more easily obtained.

Treatment. The treatment must be directed to the removal of the causative nasal disease. An alkaline lotion should be ordered, and may be varied to suit the special requirements of the case (see Chaps. VIII., IX.). Where hypertrophy of the inferior turbinates or excessive lymphoid tissue is present, operation should be carried out. Much good may often be done by curetting even a small amount of adenoid tissue.

The general treatment is of the greatest importance. A change of air, especially to the seaside or to a bracing mountain resort, will often do more good than any other treatment. Special attention must be directed to the alimentary functions: many patients suffer from indigestion and constipation, and it is quite impossible to cure their throat trouble until this has been corrected. Dieting alone may cause great improvement or even cure: in other cases suitable tonics are required.

POST-NASAL ADENOID GROWTHS.

Although small vegetations had been seen in the post-nasal space by previous observers, among whom may be mentioned Czermak, Meyer was the first to recognise the importance of these growths. In 1868 he gave an accurate description of their pathology and introduced an efficient method of treatment. Their importance was beginning to be recognised in 1881 at the International Medical Congress in London, but it is only in the last fifteen years that the far-reaching effects of adenoids have been demonstrated, and that the influence of free nasal respiration in childhood upon the development of the upper and lower jaws, teeth, face, and chest has been understood. It is possible that in some respects the pendulum of opinion has swung even too far, and a large number of affections have been ascribed to adenoids which are not really due to them. It seems certain that undue importance has sometimes been attached to the presence of a small amount of growth not producing any real symptoms, and that, in consequence, a number of unnecessary operations have been performed.

Aetiology. Adenoids are most commonly seen in children under 10 years of age. Brieger¹ considers that hypertrophy of lymphoid tissue in

¹ *Archiv für Laryngol.*, 1902, xii. p. 254.

children is an attempt to ward off infection, and that it is not required in adults. As a rule adenoids atrophy spontaneously between the ages of 15 and 20, and become more rare in every succeeding year. I have, however, seen typical cases in men of 59 and 44 years of age, and patients upwards of 30 requiring operation are not very uncommon. Furniss Potter¹ records a case at 47, Luc one at 54, Solis Cohen one at 70 years of age. On the other hand, adenoids may occur in the first years of life, even as early as at six months of age. They are said occasionally to be congenital.² It is difficult to ascertain the truth of this statement, and personally I much doubt it. The frequency of nasal catarrhs in infants, and the rapidity with which lymphoid hypertrophies may develop, are quite sufficient to account for their presence at an early age. Adenoids apparently occur in about equal frequency in both sexes. With regard to their general distribution and frequency, Meyer³ showed that adenoids have existed since Roman times, and that they occur in all races, although they are less frequent in warm climates. Decker⁴ examined 1000 school children, and considered that 127 required operation for adenoids. Barth⁵ found that adenoids existed in a greater or less degree in 30 per cent. of the recruits in the German Army. They were generally associated with enlargement of the posterior ends of the inferior turbinates. Permewan⁶ found adenoids in 63 out of 203 children. In healthy children they existed in 21 per cent., in fairly well nourished children in 30 per cent., in badly nourished children in 45 per cent. Cheatele⁷ examined 1000 children of the lowest class and found that adenoids existed in 434, 39 of which were slight cases. The ears were affected in 394 of these. These numbers show the great frequency of adenoids, and also, as would be expected, that they are more common in badly nourished children living in unhealthy circumstances, although they may occur under the best conditions.

Amongst **predisposing causes** may be mentioned:

Heredity. Instances of adenoid growths occurring in several members of a family are frequently met with and traces indicating the previous existence of the same disease may often be seen in the parents. The affection is prevalent in certain races—for instance, in the Hebrew race—and generally speaking, it is more common in those with prominent narrow noses than in those with broad flat noses. It is also possible, as Parker suggests, that there is a catarrhal diathesis, that is, a tendency to inflammation of mucous membranes, and that this also may be inherited.

¹ *Journal of Laryngol.*, 1900, xv. p. 296.

² Frankel, *Zeitschr. für Ohrenheilk.*, 1881, x. p. 113.

³ *Journal of Laryngol.*, 1895, ix. p. 417.

⁴ *Journal of Laryngol.*, 1900, xv. p. 208.

⁵ *Archiv für Laryngol.*, 1903, xiv. p. 89.

⁶ *Journal of Laryngol.*, 1902, xvii. p. 311.

⁷ *Journal of Laryngol.*, 1902, xvii. p. 282.

Anatomical Formations. Macdonald, Parker, Siebenmann, and others have stated that certain anatomical peculiarities predispose to the formation of adenoids. Premising that the congestion of the post-nasal space resulting from obstruction in the anterior parts of the nasal fossae will lead to lymphoid hypertrophy, they look upon collapse of the alae nasi, narrowing of the nasal fossae, deviations of the septum, and the presence of a high-arched palate encroaching upon the nasal cavity, as predisposing causes of adenoids. They consider these predisposing conditions hereditary, but the evidence which I have already brought forward proves that they are the results, rather than the cause, of adenoids (see Chap. IV.). Arbuthnot Lane believes that the above-mentioned anatomical peculiarities are the result of deficient nasal breathing, and that, together with the diminished oxygenization of the blood and the consequent general malnutrition, they lay a child open to infection. For these reasons children frequently get catarrh of the nose and post-nasal space, and Lane apparently believes that what is generally called adenoids is merely an infection of the lymphoid tissue in the post-nasal space. He gives no reason for the deficient nasal breathing, beyond saying that for some cause or other the child ceases to exchange a proper quantity of air at each respiration. This means that neglect of nasal breathing leads to nasal obstruction, whereas the reverse is the true sequence of events; for if the adenoids be removed and the nasal passages cleared the child will at once commence to breathe freely through the nose.

Climate. There is no doubt that climatic influences play an important rôle in the aetiology, for adenoids are much more common in damp and cold than in warm dry climates. They are also probably more common in the smoky atmosphere of a large town than in the comparatively healthy surroundings of the country. Bobone of San Remo¹ states that adenoids are very rare in the Riviera and in all dry climates.

The tubercular or **scrofulous diathesis** has been supposed to be an aetiological factor, but this is doubtful. On the other hand, syphilis, and especially the inherited form of the disease, has undoubted claims to be considered a cause of adenoids. I have also seen adenoids develop in adults as the apparent result of secondary syphilis. In infants who suffer from the profuse purulent nasal catarrh which gives to inherited syphilis its name of "snuffles," the consecutive development of adenoids is much more common.

Exciting Causes. It must be freely recognised that adenoids cannot always be ascribed to a definite cause. There seems little doubt that any form of nasal catarrh which gives rise to the presence of mucopurulent secretion in the post-nasal space may excite hypertrophy of the lymphoid tissue, probably from septic absorption. Many patients give a history of frequent colds in the head, but the latter are probably as often the result as the cause of the adenoids. It is well established that

¹*Journal of Laryngol.*, 1899, xiv. p. 546.

scarlet fever, diphtheria, and septic sore throats leave permanent enlargement of the tonsils, and these affections are probably a common source of adenoids. Even if not the original cause, the adenoids increase greatly during an attack of these affections. Further, many patients date the commencement of their symptoms from an attack of whooping cough or measles.

Pathology. Adenoids consist essentially of a hyperplasia of the lymphoid tissue normally present in the post-nasal space. The main part of the growth is attached to the vault of the naso-pharynx, and may form a central mass or fill the whole space. Occasionally the centre of the post-nasal space may be comparatively clear whilst masses of growth may be seen at the sides in Rosenmüller's fossae, and even attached to the



FIG. 121.—TWO LARGE MASSES OF ADENOID GROWTHS REMOVED BY THE CURETTE.

posterior lips of the Eustachian orifices. The mass of growth when removed entire is seen to consist of five or six more or less parallel ridges converging above and below (Fig. 121). In the intervening recesses mucous secretion or débris is apt to accumulate. In the early stages the growths are soft—later they become more fibrous. They consist of ordinary lymphoid, and a variable amount of fibrous, tissue covered with epithelium. The latter is two or three layers or more in thickness: the most superficial cells are usually columnar and ciliated, but sometimes in parts squamous or transitional. Occasionally cysts are found, apparently due to obstruction of the follicles. Görke¹ states that these retention cysts are very common in adults as the result of inflammatory thickening around the opening of the follicles. Sometimes these cysts form abscesses, as in a case recorded by Tilley.² The amount of fibrous tissue varies; a considerable deposit is often found around the vessels, which perhaps aids in their obliteration and in the consequent atrophy of the growths.

¹ *Archiv für Laryngol.*, 1902, xiii. p. 224.

² *Journal of Laryngol.*, 1903, xviii. p. 584.

Many researches have been carried out to show the connection between adenoids and tuberculosis. Brindel found tubercle 8 times in 64 cases; Pluder and Fischer 5 times in 32; Lermoyez twice in 32; Gottstein 4 times in 33; and M'Bride and Turner 3 times in 100 cases. Piffi found that only 4 per cent. of adenoids showed histological signs of tubercle; Lewin found 5 per cent. tubercular, and states that there may be no clinical signs of tubercle elsewhere in the body. In a more recent and complete investigation of 75 cases, Lartigau and Nicoll found that 10 per cent. of adenoids contained tubercles, and that the tubercle bacilli could be demonstrated in a further 6 per cent.

The organisms were generally found close under the epithelium in the neighbourhood of the crypts. It is therefore apparent that adenoids may offer an entrance for tuberculous infection. Other organisms, notably the staphylococcus and the streptococcus pyogenes, may be present: these also are most numerous near the surface of the growths just beneath the epithelium. Lartigau and Nicoll found these organisms in five out of eleven specimens, and Goure¹ in more than 50 per cent. of 201 examinations. Their presence probably explains the almost constant enlargement of the cervical glands. In children, a chain of small hard glands along the posterior border of the sterno-mastoid muscles is an almost pathognomonic sign of adenoids.

Symptoms. The symptoms of adenoids are well known. The most prominent have already been fully discussed (see Chap. IV.), so need but brief recapitulation here. They may be divided into four groups.

Nasal Obstruction and its consequences are the commonest and the most marked feature. The results of the nasal obstruction may be enumerated as follows: (1) Typical facies. The open mouth, the hanging lower jaw, the expressionless lips, the general look of stupidity, help to form the well-known "adenoid" facies. In addition, the bridge of the nose appears widened, and the anterior part of the nose narrowed; there is often collapse of the alae nasi, and a deep sulcus at the junction of the cartilages and the nasal bones. The bridge of the nose may be actually increased in width from congestion of the soft parts; it may appear bluish, or a large vein may run transversely across the root of the nose. (2) Mouth breathing, partial or complete; the patient, if a child, may breathe entirely through the mouth during the day-time, and partly through the nose at night, or he may only resort to mouth breathing during exertion or under excitement. (3) Snoring in sleep; in severe cases during the day also there is a constant snorting, snuffling, or noisy respiration. (4) Thickness of speech. The characteristic speech of nasal obstruction is generally well marked. (5) Anosmia, due either to the impossibility of the olfactory particles reaching the olfactory mucous membrane, or to the nasal catarrh. (6) Deformity of the nose, nasal septum, palate, jaws and teeth. As already pointed out (see p. 63), the arch of the palate is high and narrow, or

¹ Goure, *Annales des Mal. de l'Oreille*, 1897, xxiii. p. 437.

saddle-shaped, the alveolar arch is V-shaped, and the upper incisor teeth protrude in front of the lower, the nasal cavity is encroached upon in its vertical diameter, and the nasal septum is in consequence distorted. Both the upper and lower jaws are often ill-developed, and the teeth are crowded and irregular.

Obstruction to Free Entry of Air into the Chest during Sleep. If a child be carefully observed during sleep it will usually be noticed that, although the mouth is widely open, little or no air is passing in and out of it, and that respiration is conducted almost entirely through the obstructed nostrils. More rarely inspiration is nasal, and expiration is partially buccal. During sleep, when severe nasal obstruction is present, the child may make several inspiratory efforts, causing great retraction of the yielding chest walls, without any air entering the lungs. He then partially wakes up, gasps, draws a long inspiration through the mouth, and relapses into sleep again. Three, four, as many as ten abortive movements follow before the child again wakes up and gets a breath. As one result of this the blood is insufficiently oxygenated during sleep. The evils of this are obvious; amongst other things the children suffer from; (1) headache,¹ lassitude, capricious appetite, ill temper, especially in the morning. These symptoms pass off as the day goes on; (2) restless disturbed sleep, occasionally interrupted by "night terrors." The child may dream the same terrifying dream night after night, probably as a result of partial suffocation; he struggles violently for breath and wakes up screaming with fright and sweating profusely; (3) anaemia, impaired general health, malnutrition and stunted growth; (4) stupidity and inaptitude for mental exertion; (5) cyanosis and profuse sweating during sleep. With regard to the general health, Lichtwitz and Sabrazés² showed that the blood of adenoid patients often exhibited a leucocytosis which improved immediately after operation. Whatever the explanation may be, it is certain that children with even a small amount of adenoid growth often suffer from great impairment of the general health, and surprising improvement may follow operation.

The second effect is permanent deformity of the chest walls. There may either be pigeon breast, or a flattening of the lower ribs, with a depression over the lower part of the sternum corresponding to the attachment of the diaphragm.

Liability to Catarrh of the Upper Air Passages. Nasal obstruction leads to deficient power of blowing the nose and allows the mucous secretion to accumulate in it. This is apparently the cause of the great liability to repeated colds and of their long persistence. The tendency to take cold is increased by the deficient aeration of the blood and the impaired health. Thus post-nasal catarrh, chronic rhinitis, and hypertrophic rhinitis are very frequent, in fact when adenoids have been present for some years

¹ The headache may be in part due to disturbances in the circulation, resulting from the nasal obstruction (M'Keown, *Brit. Med. Journ.*, 1900, ii. p. 894).

² *Archiv für Laryngol.*, 1900, x. p. 278.

hypertrophy of the posterior ends of the inferior turbinates is very likely to exist. Post-nasal catarrh leads to Eustachian catarrh and obstruction, with indrawing of the membrana tympani; in the more severe cases acute or chronic middle ear catarrh, or even suppuration of the middle ear, may occur.

As the result of mouth breathing, or of extension downwards of the nasal and post-nasal catarrh, there is a tendency to catarrhal or septic affections of the throat. Children with adenoids are liable to suffer from repeated attacks of tonsillitis, pharyngitis, bronchitis, and probably are abnormally subject to all pulmonary affections. It is probable also that there is increased liability to infectious diseases, such as scarlet fever and diphtheria. There are frequent mild febrile attacks, possibly due to local inflammation of the adenoid tissue, or a mild form of septic infection. These attacks are very common in adenoid children, and when no obvious cause is discoverable adenoids should always be suspected.

A group of **symptoms due to reflex nervous disturbance** or of uncertain origin. Amongst these may be mentioned paroxysmal sneezing, hay fever, and asthma, instances of which cured by the removal of adenoids are not very uncommon. Laryngeal spasm may be met with, probably as the result of mild laryngitis but possibly due in part to asphyxia. Thus I have frequently observed children sleeping at night snoring vigorously, the snoring gradually becoming deeper and deeper and the child more cyanosed, until a distinct laryngeal note could be detected.¹

Laryngismus stridulus may be benefited by the removal of adenoids, but the exact relationship of one to the other is unknown. A spasmodic cough is common in adenoids: but it probably depends upon pharyngitis or laryngitis, and is not a true reflex.² Neither is stammering a direct consequence of adenoids, although it may be difficult or impossible to cure the patient until the nasal obstruction has been removed.

The dependence of epilepsy and chorea upon adenoids is doubtful, and when improvement in these affections has followed operation it has probably been due to the improvement in the general health. Lennox Browne³ has recorded two cases of epilepsy greatly improved by the removal of adenoids. Bromide of potassium in small doses stopped the attacks after operation, although previously large doses had failed. Mayo Collier and Dundas Grant⁴ apparently concur in these statements. (For other cases see page 75.) A recent successful case has been published by StClair Thomson.⁵ It must be borne in mind that children with well marked nasal obstruction often suffer from convulsions during sleep.

¹ Lack, *Journ. of Laryngol.*, 1898, xiii. p. 303.

² Hutchison, *Clinical Journal*, 1902, January 29.

³ *Journ. of Laryngol.*, 1900, xv. p. 661.

⁴ *Journ. of Laryngol.*, 1901, xvi. p. 157.

⁵ *Practitioner*, 1905, lxxiv. p. 630.

These are sometimes described as epileptiform, but they are probably the direct result of asphyxia, and have nothing to do with true epilepsy. They may be at once cured by restoring nasal respiration.¹

Epistaxis is common; it may be frequent, but is rarely profuse. It probably depends upon some alteration in the circulation of the nose, a direct result of the obstruction to breathing.

Nocturnal enuresis is frequently associated with adenoids, and the removal of the latter effects a cure in a proportion variously estimated at a quarter to three-quarters of the cases. Thus Grönbech² cured twelve cases out of twenty-three. The symptom probably depends upon deficient aeration of the blood, or upon the disturbances of the circulation resulting from the nasal obstruction, and it is not a true reflex. Many cases improved by operation subsequently relapse, which goes to show that nasal obstruction is only one factor, and probably not the most important one in the causation of the affection.

Diagnosis. The diagnosis may usually be made from the symptoms alone. The typical facies, the history of snoring during sleep, the repeated attacks of earache and deafness, and of colds in the head, leave little doubt as to the presence of adenoids. If very large tonsils are seen in young children or if a chain of small hard glands is found along the posterior border of the sterno-mastoid muscle, adenoids should always be suspected. These remarks only hold good when no operation has been performed, for occasionally the symptoms persist, or after a brief interval recur, usually because of some nasal trouble, and reproduce the picture of adenoids although no recurrence has taken place.³ In all doubtful cases it is necessary to examine the post-nasal space either with the finger or with a mirror. Whenever possible the mirror should be used: with a little patience this method can be practised even in small children without any discomfort. The growths appear as a smooth or somewhat irregular reddish mass projecting from the vault of the pharynx. Their amount can be gauged by the degree of obstruction to the post-nasal space and by the amount of the upper part of the nasal septum which is concealed from view (Fig. 122).

When the mirror cannot be used a digital examination must be made: this is painful and therefore better avoided unless really necessary. It is practised as follows: the surgeon stands behind the patient, holds the head with his left arm, places his left hand on the patient's lower jaw, and holds a pad between the teeth. This prevents the patient suddenly moving his head or closing his mouth. The right fore-finger is now slipped rapidly backwards over the tongue and up behind the soft palate. The amount of soft tissue in the vault of the pharynx can be readily

¹ See Macdonald, *Diseases of the Nose*, pp. 215, 240.

² *Archiv für Laryngol.*, 1895, ii. p. 314.

³ See also Dundas Grant, *Journ. of Laryngol.*, 1897, xii. p. 413.

ascertained, as can also the presence of enlarged posterior extremities of the inferior turbinates, a not infrequent complication.

The following conditions may simulate adenoids: (1) Nasal polypus projecting into the post-nasal space. (2) Post-nasal fibroma or sarcoma. (3) Enlargement of the posterior extremities of the inferior turbinates. (4) Retropharyngeal abscess. (5) An abnormally prominent vertebral column. Occasionally the bodies of the second or third cervical vertebrae project abruptly forward, and unless great care be taken when using a mirror may deceive the observer.¹ (6) Diminutive size, or bony or fibrous occlusion of the posterior choanae. (7) Meningocele. All these affections can be excluded by a careful use of the mirror supplemented, when necessary, by digital examination.

Treatment. The first point to decide is whether the growths should be removed at once or whether expectant treatment may be adopted for



FIG. 122.—DIAGRAM ILLUSTRATING THE ESTIMATION OF ADENOIDS BY POSTERIOR RHINOSCOPY. Showing the mirror in position and the way in which the adenoids intercept the view of the posterior nares. 1, 2, 3, the superior, middle and inferior turbinates respectively.

a time. The general tendency at the present day is perhaps to operate too much, but, although the operation is a simple one, it is not absolutely free from risk. There are always present the dangers of the anaesthetic, of blood entering the air passages during the operation,² and the more remote risks of loss of blood, of sepsis and of acute ear troubles. Still when carefully performed the danger may be minimised, and is no reason for avoiding operation when the growths are giving rise to definite symptoms. When any of the well recognised results of adenoids are present, operation should be advised. It is necessary to be more cautious when dealing with such symptoms as stammering, chorea, nocturnal enuresis,

¹ See Magenau, *Archiv für Laryngol.*, 1900, xi. p. 101.

² Statistics published in 1896 showed that eleven deaths occurred in two years in England alone from these causes. (Marsh.)

epilepsy and asthma. I should not advise operation unless a fair amount of adenoids was present causing other and more definite symptoms, or except with the view of improving the general health. In any case the prognosis with regard to the cure of these symptoms must be guarded.

Expectant treatment may be adopted when a small amount of growth is present causing few and unimportant symptoms. It is especially indicated when the growths are of recent origin and the symptoms are mainly due to the associated catarrh. Expectant treatment consists in improving the general health, in the local application of astringents, and in the administration of certain drugs. The best results are obtained by measures directed solely to the improvement of the general health, such as a change to the seaside or to a dry bracing climate, combined with tonics such as cod liver oil and iron. These measures will often effect a cure when the symptoms are mainly due to catarrh, or when the growths are soft and of recent origin. The post-nasal catarrh being cured, the growths diminish in size and give rise to no symptoms.

The administration of iodine in small doses and of various other drugs has frequently been recommended. The course of treatment generally extends over some length of time, and it is probable that time is the chief factor in the success which may attend these measures. It apparently matters little which, if any, drug be given. The local application of astringents has been highly recommended.¹ Strong solutions of perchloride of iron, of tannic acid and of other astringents have been applied to the post-nasal space directly by means of a brush. These applications should be made by the physician himself and not entrusted to the patient. It has also been recommended to syringe weaker solutions of these drugs down the nostrils.² They are chiefly of benefit in the catarrhal cases. In my opinion better results are obtained by the use of the simple alkaline lotion, in fact by carrying out treatment as for chronic rhinitis combined with the general treatment above recommended.

Another treatment widely recommended of recent years, especially by Arbuthnot Lane, is systematic breathing exercises. The child is directed to lie flat on his back for half an hour once or twice a day, and to breathe deeply in and out through the nose. This method has been vaunted as an actual cure for adenoids. The remedy is useful in the mild catarrhal cases above described, and it will sometimes greatly assist in the disappearance of the symptoms after operation.

Operation. When adenoids are of long standing or a considerable amount of firm growth is present no treatment short of removal offers any hope of success, and general measures should only be adopted to improve the child's health previous to operation. This little operation is so well known that a brief description will suffice. The great points.

¹ Parkinson, *Clinical Journal*, April 16th, 1902.

² Pritchard, *Diseases of the Ear*, 2nd edit., 1891, p. 123.

are to operate as thoroughly and as quickly as possible. Thoroughness ensures that the best results will be obtained, the most complete relief of symptoms with the least danger of recurrence. The more quickly the operation is performed the less becomes its danger.

No special preparation of the patient is necessary; it is useless, indeed harmful, to syringe the nose with antiseptic solutions (see page 50). The ordinary surgical precautions with regard to sterilizing the operator's hands, instruments and sponges must be adopted.

Anaesthetic. Much controversy has arisen with regard to the best anaesthetic, or indeed as to whether any be required. Many operators prefer chloroform—others insist upon its dangers¹ and give their preference to ether, nitrous oxide, or other anaesthetic. Nitrous oxide is undoubtedly the safest, but if another anaesthetic be preferred it probably matters very little which is given provided it is carefully administered and not pushed to excess. The anaesthetist should remember that nasal obstruction is present, and that although the respiratory movements may be apparently satisfactory, it is of the utmost importance to note that the air is actually passing in and out of the chest. It is often necessary to put a gag in the mouth and to hold the tongue forward during the whole time of anaesthesia. The anaesthesia should never reach the stage at which the reflexes are completely lost. Before operating the finger should be passed into the post-nasal space; the operation should not be commenced, and care should be taken to avoid making the parts bleed, until a definite reflex can be excited. It is of great assistance to the operator if the patient is able to swallow the blood or to cough up any that accidentally enters the larynx. In this way sponging of the throat is avoided, and as I have repeatedly observed, it is the sponging, and not the operation, that causes the bruising and oedema of the palate and the painful dysphagia. A good anaesthetic for children is to commence with the A.C.E. mixture and to finish with ether as recommended by Rowell. The A.C.E. mixture, chloroform, or ether may all be given safely if the above precautions are borne in mind, and personally I prefer one of these anaesthetics for children. In adults with a small central mass of growth and with no complications such as enlargement of the posterior ends of the inferior turbinates, nitrous oxide, or, better, nitrous oxide and oxygen, may be given. These anaesthetics are not very satisfactory in children owing to the short duration of the anaesthesia and the tendency to produce cyanosis and struggling. Ethyl chloride has lately been tried and apparently acts better in children; it gives a slightly longer anaesthesia without the struggling which occurs under gas and the patient makes a rapid recovery. It is useful in hospital practice when the patient must return straight home from the out-patient room. Two methods of operating only need be described. The operations with the finger-nail or the steel finger-nail,

¹Hinkie reports no less than 18 deaths from this anaesthetic in adenoid operations. *Journ. of Laryngol.*, 1898, xiii. p. 382.

with the galvano-cautery, with the snare and with various guillotines are all happily obsolete.

Operation under Nitrous Oxide. When operating under nitrous oxide or ethyl chloride anaesthesia, the patient is seated upright in a dental chair and a strong light is allowed to fall on to the back of his throat, or reflected light from a head mirror may be used. When the patient is anaesthetized the finger should be inserted into the post-nasal space to ascertain the amount and consistence of the growth and to break through any adhesions between the central mass and the lips of the Eustachian tubes. Then a Gottstein's curette, or one of its modifications, is passed up behind the palate until it reaches the nasal septum. The handle of the instrument is depressed and the blade, pressed against the posterior



FIG. 123.—BECKMANN'S CURETTE FOR REMOVING POST-NASAL ADENOID GROWTHS.

edge of the septum, is pushed backwards until the vault of the naso-pharynx is reached. The handle is now sharply raised and the blade swept downwards over the posterior pharyngeal wall. In this way the whole growth can often be removed with a single cut. The curette is again introduced and rapidly swept over both sides of the posterior wall, the finger inserted to make sure that the growth has been completely removed, and then the patient's head should be bent forward over a bowl to allow the blood to run away. Great care must be taken not to leave a "tag" of growth hanging down the pharynx attached by a thin strand of mucous membrane. After the anaesthetic has passed off this tag often excites violent coughing and retching. The pharynx must be inspected and the piece removed with forceps. The accident may be avoided by sweeping the blade of the curette well down the pharynx and by using a sharp instrument. In adults this method is quite satisfactory; plenty of time is allowed for thorough removal of the growths and there is little or no danger. In children, however, owing to the great tendency to struggling and cyanosis there is some difficulty in operating properly and some danger of blood entering the air passages and causing laryngeal spasm. I once had to perform tracheotomy, under these circumstances. Such operations may yield imperfect results and recurrence of the growths is common; therefore in young children I should always prefer other and more reliable anaesthetics.

Operation under Chloroform or Ether. The patient should lie on an ordinary operating table with the head slightly raised on a pillow. When anaesthesia has been induced the forefinger of the left hand is passed into the post-nasal space and, guided by it, Löwenberg's forceps, or some modification of them, are introduced. A large mass of the growth

is seized and detached by twisting it off rather than by pulling. After one or two pieces have thus been taken away a Gottstein's curette may be introduced and the parts thoroughly scraped, until all the growths have been removed and the walls are left quite smooth. Small pieces of growth in Rosenmüller's fossae, or projecting into the posterior choanae, may be best removed with Meyer's original adenoid curette introduced through the mouth. When necessary the posterior ends of the inferior turbinates and the tonsils may next be removed. If there is much bleeding the patient should be rolled over on his side and the blood allowed to run into the cheek, from which it can be gently wiped away. If the anaesthetic be not pushed too deeply there is no need to sponge the pharynx. I much prefer the position above described to the one formerly adopted with the head hanging over the end of the table. In this position it is



FIG. 124.—JURACZ'S FORCEPS FOR REMOVING POST-NASAL ADENOID GROWTHS.

more difficult to operate, the operation takes longer, the bleeding is increased from the pressure upon the veins in the neck, and it is more difficult for the patient to cough or to swallow—the operation is therefore probably more dangerous. The best position of all when there is much bleeding is to turn the patient upon his side, or even slightly over on to his face, when all the blood will run out of the nose or into the mouth.

After-treatment. Immediately the operation is finished the patient's face should be sponged with cold water to arrest the haemorrhage. This is never serious and soon ceases. In simple cases the patient should keep his bed for two or three days, and remain in the house for two or three days longer, according to the weather. The food for the first twenty-four hours should be cold, and soft food is required for a few days. On the second night it is generally necessary to give an aperient, as the patient's stomach is upset by the blood which has been swallowed. I believe it is better to avoid syringing the nose unless the breath is foetid and the nose seems full of discharge, when it may be washed out once or twice with some weak boracic lotion. As a rule the operation gives rise to but little discomfort, but sometimes there is pain in the back of the neck. It is rarely severe and requires no special treatment. Adults complain of the pain much more than children.

Dangers. The chief risks of the operation arise from the anaesthetic, from blood entering the air passages and producing asphyxia during anaesthesia or pneumonia subsequently, from haemorrhage primary or secondary, from general sepsis, and from septic affections of the throat and ears.

The risk of blood entering the air passages is a serious one. Twice I have had to perform tracheotomy for this cause, and on other occasions alarming symptoms have occurred, but have fortunately been relieved by prompt inversion of the patient. The risk may be best avoided by operating under light anaesthesia with the swallowing and cough reflexes present. If the operation has been performed with the patient lying on his side he should not be rolled upon his back suddenly, or the blood which has accumulated in the cheek may be displaced into the larynx. If blood should accidentally enter the air passages and cause obstruction to breathing, the best plan is immediately to invert the patient. The mouth should be opened with a gag, the tongue pulled forward, and the finger passed into the larynx to excite a cough. If this fails tracheotomy must be performed.

Primary haemorrhage is a very rare occurrence. Marsh and Martin each record one case.¹ In the latter's case, a boy aged sixteen, the bleeding commenced an hour and a half after operation, and necessitated plugging of the post-nasal space. Sachs² records fatal haemorrhage following operation in a haemophilic patient. Secondary haemorrhage is more common: it has occurred three or four times in my own practice. Goldsmith³ records a case which was fatal on the fourth day, and Martin⁴ two, one of which required plugging. They all probably resulted from a septic condition of the post-nasal space, and might possibly have been prevented if the nasal passages had been cleansed regularly when foul discharge first appeared. My own cases have not been serious, and the bleeding has been arrested spontaneously or by sponging the face with cold water, and by giving ice to suck.

In two of my cases pneumonia has followed operation, and has probably been due to blood entering the lungs owing to too deep anaesthesia. Septic sore throats, tonsillitis, and fever are rare, but may occur, especially in hospital practice. To a large extent they may be avoided by taking the usual precautions of surgical cleanliness, by syringing the nose when indicated, and especially by operating in a surgically clean home. Acute otitis media results either from sepsis or from blood entering the Eustachian tubes during the operation. It may lead to suppuration and to serious ear trouble, but these graver cases are fortunately very rare. I believe these untoward results have often been caused by excessive zeal in syringing the nose after operation, or by the too early use of Politzer's method of inflation to improve the hearing. The earliest signs are acute pains in the ear and increase of the deafness. This complication must be energetically treated by counter-irritation over the mastoid, by gentle inflation to open the Eustachian tubes, and by early paracentesis if necessary.

In a few cases I have observed severe torticollis, and other cases are on

¹ *Laryngoscope*, 1899, vii. p. 241.

² *Journ. of Laryngol.*, 1900, xv. p. 61.

³ *Journ. of Laryngol.*, 1903, xviii. p. 161.

⁴ *Op. cit.*

record.¹ This is probably due to septic enlargement of the glands under the sterno-mastoid, and disappears in a few days.

Prognosis. If the patient be operated upon early enough all the symptoms will disappear, but when bony deformities have already occurred, such as alteration in the shape of the upper jaw, they will probably always leave some traces. Thus the anterior part of the upper jaw may remain considerably narrowed, although the posterior part commences to develop immediately the adenoids have been removed. The deformities of the chest, if not too pronounced, will usually recover completely, especially in young children and if suitable breathing exercises are carried out. That great improvement in the general health should follow the operation is not to be wondered at: the children generally become brighter, more active mentally, and put on flesh and grow in a remarkable manner. The results with regard to hearing are uniformly good if the ear trouble be not too far advanced. Even when old standing catarrh is present, when there is a perforation of the drum or chronic suppuration in the middle ear, great improvement may be produced. Some guide to the amount of improvement which may be anticipated from operation may be obtained by observing the results of inflation by Politzer's method. If this yields no improvement the prognosis must be guarded; if improvement be obtained, still greater benefit will be derived from operation. It is a remarkable fact that the hearing often improves immediately after the operation, that is within an hour or two, and the immediate may be as good as the ultimate result.² It is difficult to explain this, but it is probably due to some alteration in the circulation produced by the free hæmorrhage. Probably alterations in the circulation also account for the improvement which follows operation when an old perforation of the drum is present, or when there is active suppuration of the ears. In these cases there is no diminished air tension in the tympanum, and no indrawing of the drum to which the deafness in adenoids is commonly attributed.

With regard to **recurrence** a few words must be said. The more complete and thorough the operation the less the likelihood of recurrence. In children over ten, recurrence probably means incomplete removal. When operations are performed at very early ages, for instance at three or four years or under, recurrence may occur. It may be due to the difficulty of complete removal, or it may be that the child takes frequent colds, or a severe cold is neglected, or it suffers from a severe infection, such as scarlet fever, measles, diphtheria, etc., which starts a fresh growth of adenoids. If, however, the operation be thoroughly performed recurrence even at early ages is extremely rare. It must be borne in mind that the continuance or the recurrence of symptoms such as nasal obstruction need not necessarily imply recurrence of adenoids. They may be due to some nasal disease, such as deflected

¹ Marsh, *Lancet*, 1902, ii. p. 1751. Ingersoll, *Journ. of Laryngol.*, 1902, xvii. p. 486.

² M'Keown, *Brit. Med. Journ.*, 1900, ii. p. 645, and 1901, ii. p. 896.

septum or hypertrophic rhinitis, the existence of which had been previously overlooked.

Bibliography.

- MEYER. Archiv für Ohrenheilk., 1873, i. p. 241.
 MEYER. Journ. of Laryngol., 1895, ix. p. 417.
 WINGRAVE. Journ. of Laryngol., 1901, xvi. p. 505.
 CHEATLE. Journ. of Laryngol., 1902, xvii. p. 282.
 BARTH. Archiv für Laryngol., 1903, xiv. p. 89.

Normal Anatomy.

- HEYMANN'S Handbuch der Laryngol., etc., Wien, 1899. Bd. iii. p. 534.
 GÖRKE (Die Involution der Rachenmandel). Archiv für Laryngol., 1904, xvi. p. 144.

Pathological Anatomy.

- LERMOVEZ. Annales des Mal. de l'Oreille, 1894, xx. p. 979.
 PLUDER AND FISCHER. Archiv für Laryngol., 1896, iv. p. 372.
 BRINDEL. Journ. of Laryngol., 1896, xi. p. 146, and Rev. Hebd. de Laryngol., 1896, xvi. pp. 881, 913.
 GOTTSTEIN. Berlin. klin. Woch., 1896, xxxiii. p. 689.
 MCBRIDE AND TURNER. Journ. of Laryngol., 1897, xii. p. 393, and Edinb. Med. Journ., 1897, xliii. pp. 355, 471, 598.
 PIFFI. Journ. of Laryngol., 1899, xiv. p. 612.
 LEWIN. Archiv für Laryngol., 1899, ix. p. 377.
 LARTIGAU AND NICOLL. Amer. Journ. Med. Sci., 1902, cxiii. p. 1031.

Treatment.

- Discussion on. Journ. of Laryngol., 1897, xii. p. 306.
 MARSH. Lancet, 1902, ii. pp. 1587, 1751.

APPENDIX OF USEFUL FORMULAE.

THE following formulae have been selected as useful examples of the various forms of local application required in the treatment of diseases of the nose. They are mainly derived from the last edition of the *Pharmacopoeia* of the Hospital for Diseases of the Throat, which was edited by Mr. C. A. Parker and myself with the assistance of our colleagues.¹ Many of the prescriptions are based upon those of earlier pharmacopoeias which were edited by the late Sir Morell Mackenzie. The metric system of weights and measures is introduced for the benefit of any foreign reader. This was done for the editors of the *Pharmacopoeia* by Messrs. Bullock and Co.

Nasal Lotions. These lotions are mainly used for cleansing purposes: when there is any special indication, this is stated. For the methods of using the lotions the reader is referred to pages 43 and 45. It is convenient to prescribe the lotion four times the strength indicated and to direct the patient to add half an ounce of it to two ounces of warm water for use. Some of the lotions may also be prescribed in the form of compressed tablets, a great convenience to patients who have to travel.

I.

Bicarbonate of Sodium,	3 gr. = 0.21 gm.
Borax,	3 gr. = 0.21 gm.
Carbolic Acid,	1 gr. = 0.07 gm.
White Sugar,	5 gr. = 0.34 gm.
Water,	to 1 oz. = 30 c.c.

II.

Bicarbonate of Sodium,	2 gr. = 0.14 gm.
Borax,	2 gr. = 0.14 gm.
Chloride of Sodium,	2 gr. = 0.14 gm.
White Sugar,	5 gr. = 0.34 gm.
Water,	to 1 oz. = 30 c.c.

III.

Chloride of Ammonium,	5 gr. = 0.34 gm.
Chloride of Sodium,	3 gr. = 0.21 gm.
White Sugar,	5 gr. = 0.34 gm.
Water,	to 1 oz. = 30 c.c.

Mild stimulant.

IV.

Antipyrine,	5 gr. = 0.34 gm.
Sulphate of Zinc,	$\frac{1}{2}$ gr. = 0.034 gm.
Liquid Extract of Hamamelis,	30 m. = 1.87 c.c.
Water,	to 1 oz. = 30 c.c.

Astringent.

V.

Compound Tincture of Benzoin,	5 m. = 0.31 c.c.
Borax,	5 gr. = 0.34 gm.
White Sugar,	5 gr. = 0.34 gm.
Water,	1 oz. = 30 c.c.

Mild sedative.

VI.

Glycerine of Borax,	10 m. = 0.62 c.c.
Rectified Spirit,	10 m. = 0.62 c.c.
Water,	1 oz. = 30 c.c.

Mild astringent.

¹ The *Pharmacopoeia* of the Hospital for Diseases of the Throat, Golden Square. Sixth edition. 1901. London: J. & A. Churchill.

VII.

Boro-Glyceride,	30 gr. = 2.06 gm.
Chloride of Sodium,	5 gr. = 0.34 gm.
Water,	1 oz. = 30 c.c.

VIII.

Bicarbonate of Sodium,	4 gr. = 0.27 gm.
Borax,	4 gr. = 0.27 gm.
Benzoate of Sodium,	$\frac{1}{2}$ gr. = 0.011 gm.
Eucalyptol,	$\frac{1}{12}$ m. = 0.006 c.c.
Menthol,	$\frac{1}{12}$ gr. = 0.003 gm.
Water,	to 1 oz. = 30 c.c.

A mild sedative and antiseptic.

IX.

Hazelin,	20 m. = 1.25 c.c.
Borax,	5 gr. = 0.34 gm.
Glycerine,	5 m. = 0.31 c.c.
Water,	1 oz. = 30 c.c.

Astringent.

X.

Chloride of Sodium,	$3\frac{1}{2}$ gr. = 0.24 gm.
Borax,	$1\frac{1}{2}$ gr. = 0.1 gm.
Benzoate of Sodium,	$\frac{1}{2}$ gr. = 0.017 gm.
Menthol,	$\frac{1}{16}$ gr. = 0.007 gm.

Hydrochloride of Cocaine,

	$\frac{1}{12}$ gr. = 0.006 gm.
Water,	1 oz. = 30 c.c.

Sedative.

XI.

Phosphate of Sodium,	$\frac{1}{2}$ gr. = 0.017 gm.
Sulphate of Sodium,	$2\frac{1}{2}$ gr. = 0.17 gm.
Chloride of Sodium,	$1\frac{1}{2}$ gr. = 0.1 gm.
Bicarbonate of Sodium,	$\frac{1}{2}$ gr. = 0.034 gm.
Phosphate of Potassium,	$\frac{1}{2}$ gr. = 0.017 gm.
Water,	1 oz. = 30 c.c.

XII.

Chlorate of Potassium,	$2\frac{1}{2}$ gr. = 0.17 gm.
Borax,	$2\frac{1}{2}$ gr. = 0.17 gm.
Bicarbonate of Sodium,	$2\frac{1}{2}$ gr. = 0.17 gm.
White Sugar,	5 gr. = 0.34 gm.
Water,	1 oz. = 30 c.c.

XIII.

Sanitas,	30 m. = 1.87 c.c.
Chloride of Sodium,	5 gr. = 0.34 gm.
Water,	1 oz. = 30 c.c.

Antiseptic and deodorant.

Nasal Insufflations. These are intended to be used as snuffs. The first is an example of a sedative insufflation (the well-known Ferrier's snuff), sometimes of use in acute rhinitis. The second is sedative and antiseptic.

XIV.

Carbonate of Bismuth,	280 gr. = 19.20 gm.
Acetate of Morphine,	8 gr. = 0.55 gm.
Gum Acacia in fine powder,	to 1 oz. = 30 gm.

XV.

Menthol,	8 gr. = 0.55 gm.
Iodol,	80 gr. = 5.48 gm.
Boric acid in fine powder,	200 gr. = 13.71 gm.
White sugar in fine powder,	to 1 oz. = 30 gm.

Local Anaesthetics. These are used by the surgeon for producing local anaesthesia, and must never be entrusted to the patient. For method of using, see page 47.

XVI.

Hydrochloride of Cocaine,	48 to 96 gr. = 3.3 to 6.6 gm.
Salicylic Acid,	$\frac{1}{2}$ gr. = 0.034 gm.
Distilled Water,	to 1 oz. = 30 c.c.

XVII.

Hydrochloride of Cocaine,	48 gr. = 3.3 gm.
Suprarenal Extract (Merck),	24 gr. = 1.64 gm.

Salicylic Acid,	$\frac{1}{2}$ gr. = 0.034 gm.
Distilled Water,	to 1 oz. = 30 c.c.

Anæsthetic and powerful astringent.

XVIII.

Hydrochloride of Eucaine,	40 gr. = 2.74 gm.
Salicylic Acid,	$\frac{1}{2}$ gr. = 0.034 gm.
Distilled Water,	1 oz. = 30 c.c.

Sprays for the Nose and Throat. The first may be used in an ordinary spray producer. Those containing oil must be used with an atomiser or may be applied by means of a brush (see page 46).

XIX.

Bicarbonate of Sodium,	15 gr. = 1.03 gm.
Borax,	15 gr. = 1.03 gm.
Carbolic Acid,	4 gr. = 0.27 gm.
Glycerin,	45 m. = 2.80 c.c.
Water,	to 1 oz. = c.c.

XX.

Oil of Eucalyptus,	20 m. = 1.25 c.c.
Oil of Almonds,	to 1 oz. = 30 c.c.
Antiseptic.	

XXI.

Menthol,	10 to 30 gr. = 0.69 to 2.06 gm.
Oil of Almonds,	1 oz. = 30 c.c.
Sedative.	

Note.—Formulae XX. and XXI. may be usefully combined.

XXII.

Menthol,	10 gr. = 0.69 gm.
Cocaine,	5 gr. = 0.34 gm.
Oleic Acid,	15 m. = 0.95 c.c.
Liquid Paraffin,	1 oz. = 30 c.c.
Sedative.	

XXIII.

Nitrate of Mercury Ointment,	40 gr. = 2.74 gm.
Oil of Almonds,	$\frac{1}{2}$ oz. = 15.00 c.c.
Paroleine,	to 1 oz. = 30.00 c.c.
Antiseptic.	

XXIV.

Cocaine,	3 gr. = 0.21 gm.
Gum Camphor,	15 gr. = 1.03 gm.
Quinine,	10 gr. = 0.69 gm.
Oleic Acid,	30 m. = 1.87 c.c.
Paroleine,	to 1 oz. = 30 c.c.
Astringent.	

Pigmentum. This is a useful formula for Mandl's solution, and is intended as a local application to be applied with a brush to the post-nasal space.

XXV.

Iodine,	6 gr. = 0.41 gm.	Oil of Peppermint,	5 m. = 0.31 c.c.
Iodide of Potassium,	20 gr. = 1.37 gm.	Glycerin,	to 1 oz. = 30 c.c.
		Stimulant.	

Steam Inhalations. Unless otherwise indicated one teaspoonful of the fluid is to be added to a pint of water at a temperature of about 140° F., and the steam is to be inhaled through the nose for 5 or 6 minutes, twice or three times a day. For method of using, see page 46.

XXVI.

Benzoic Acid,	3 gr. = 0.21 gm.
Kaolin,	12 gr. = 0.82 gm.
Rub together and add	
Water,	$\frac{1}{2}$ oz. = 15 c.c.
Tincture of Tolu,	18 m. = 1.14 c.c.
Shake and make up the quantity with	
Water,	to 1 oz. = 30 c.c.
Sedative.	

XXVII.

Compound Tincture of Benzoin,	1 oz. = 30 c.c.
Sedative.	

XXVIII.

Oil of Cubebs,	40 m. = 2.5 c.c.
Light Carbonate of Magnesium,	
	20 gr. = 1.37 gm.
Water,	to 1 oz. = 30 c.c.
Stimulant.	

XXIX.

Oil of Eucalyptus,	20 m. = 1.25 c.c.
Light Carbonate of Magnesium,	
	10 gr. = 0.69 gm.
Water,	to 1 oz. = 30 c.c.

XXX.

Menthol, 16 gr. = 1.1 gm.
 Rectified Spirit, 2 dr. = 7.5 c.c.
 Light Carbonate of Magnesium, 8 gr. = 0.55 gm.
 Water, to 1 oz. = 30 c.c.
 One teaspoonful to a pint of water at
 100 deg. F., or 37.8 deg. C.
 Sedative.

XXXI.

Oil of Scotch Pine, 40 m. = 2.5 c.c.
 Light Carbonate of Magnesium, 20 gr. = 1.37 gm.
 Water, to 1 oz. = 30 c.c.
 Mild stimulant.

XXXII.

Terebene, pure, 40 m. = 2.5 c.c.
 Light Carbonate of Magnesium, 20 gr. = 1.37 gm.
 Distilled Water, to 1 oz. = 30 c.c.
 Stimulant.

XXXIII.

Liquid Carbolic Acid, 1 dr. = 3.75 c.c.
 Carbonate of Ammonium, 2 dr. = 7.5 gm.
 Powdered Wood Charcoal, 2 dr. = 7.5 gm.
 Compound Tincture of Benzoin, 1 dr. = 3.75 c.c.
 Oil of Lavender, 6 m. = 0.37 c.c.
 Strong Solution of Ammonia, 3 dr. = 11.25 c.c.

To be sprinkled on a respirator and
 inhaled. Recommended for use in the
 early stage of an acute catarrh. See
 page 129.

INDEX.

- ABSCCESS** of brain, 281
 of orbit, 308
 of septum, 121
 (retro-pharyngeal, acute), rare complication of sinus suppuration, 281
- Accessory sinuses** (Nasal), anatomy of, 10
 carcinoma of, 232
 cysts in, due to chronic suppuration, 279
 extent of, 24
 histology of, 29
 mucocoeles of, 358-366
 polypi in, due to chronic sinus suppuration, 279
 suppuration in, relation of ozaena to, 157
 relation of nasal polypi to, 179, 183, 185
 supra-orbital headache in, 90
 suppuration in (acute), clinical history, 284
 diagnosis, 285
 etiology, carious teeth, 274
 infection of one sinus by another, 275
 infective diseases (acute), 267
 influence of pre-existing nasal obstruction, 272
 mode of infection, 271
 presence of foreign body, 274
 relationship to erysipelas, 270
 relationship to pneumonia, 270
 repeated catarrhs of sinus, 272, 273
 rhinitis (acute), 271
 rhinitis (atrophic), 273
 trauma, 274
 tubercle, syphilis, and malignant disease, 274
 pathological changes in, 278
 treatment, 285-288
 application of cocaine and supra-renal extract, 286
 hot fomentations, 286
 irrigation, 287
 local blood-letting, 286
 suppuration in (chronic), complications, 297
- Accessory sinuses**
 suppuration in (chronic)
 conditions of occurrence: bad position for drainage of natural openings of cavities, 276
 blocking of outlet of cavity, 276
 continuance of cause in action, 277
 repeated attacks of catarrh, 277
 severity of original infection, 277
 small size of natural openings of cavities, 276
 diagnosis (*latent empyema*) bone changes, caries or necrosis, 300
 exploration of sinuses, 304
 history of illness, 298
 localisation of oedema and polypus, 300
 purulent discharge, 298, 299
 transillumination, 301
 diagnosis (*manifest empyema*), 308
 pathological changes in, 278
 in bony walls, 279, 280
 in mucous membrane, 279
 in surrounding tissues, 280, 281
 phthisis erroneously diagnosed in cases with pyrexia, 281
 pneumonia (circumscribed) with pyrexia accompanying, 281
 remote and constitutional effects of, 281, 282
 See also Cerebral complications, Dyspepsia, Septic absorption
 symptoms (*latent empyema*), 289
 affections of ear, 296
 discharge, 293
 headache, 290
 impairment of general health, 297
 loss of smell and taste, 295
 nasal obstruction, 294
 pain, 290
 polypi and oedematous hypertrophies, 295
 redness and swelling, 295
 remote symptoms, 295
 septic absorption (acute), 296
 tenderness, 292
 weakness of eyes, 296

- Accessory sinuses
suppuration in (chronic)
symptoms (*manifest empyema*), 290
treatment, general, 311
tumours of, 219-242
tumours, malignant, operative treatment of, 238
(See also Antrum, Frontal sinus, Ethmoidal cells, Sphenoidal sinus.)
- Adenoid growths (post-nasal), 368
causes, exciting, 370
predisposing, 369, 370
cough associated with, 75
dependency of chorea upon, 374
dependency of epilepsy upon, 374
diagnosis of, 375
epistaxis common in, 375
laryngismus stridulus in, 374
liability to catarrh of upper air passages in, 373
nasal obstruction in, 372
nocturnal enuresis in, 375
obstruction to free entry of air into chest during sleep in, 373
"pigeon"-breast due to, 73
pneumonia following removal of, 381
prognosis, 382
recurrence of, 382
treatment of, 376
expectant, 377
operative, 377-382
after-treatment, 380
choice of anæsthetic, 378
dangers, 380-382
- Adenoma (nasal) 225
- Adrenalin, 50
- Air-cells of nose. See Accessory sinuses
- Air, inspired, purified from dust and micro-organisms by nasal mucous membrane, 31
saturated with moisture, 31
warmed, 31
- Air passages (diseases of) dependent on nasal affections, 90, 91
(upper) catarrh of, liability to in post-nasal adenoid growths, 373
- Air pressure in nose in normal respiration, 30
- Air stream, path of, through nose, 29, 30
- Alæ nasi, collapse of, 81
due to nasal obstruction, 81
treatment, by expansion of nostrils, 81
by injection of paraffin wax, 82
operative treatment, 81
- Alcoholism (chronic), causing epistaxis, 84
- Alkan, on cause of deformities of jaws and teeth due to nasal obstruction, 69
- Alveolar puncture in treatment of chronic antral suppuration, 314
- Alveolus, deformity of, due to nasal obstruction, 64, 65
- Anæsthesia (local) in nasal operations, 48
cocaine, 48, 385
eucaine, 49
supra-renal gland extract, 49
See also under Cocaine
- Anosmia, 93, 94
direct effect of nasal-obstruction, 55, 57
- Anosmia
in chronic suppuration in accessory sinuses, 295
(central), 95
treatment, 95
(essential), causes of, 94
influenza, 94
treatment, 95
(obstructive), causes of, 94
treatment, 94
- Antisepsis in nasal operations, 50, 51
- Antrum knives or chisels, 326
- Antrum (maxillary), anatomy of, 11
development of, 13
mucocoele of, 362
suppuration in, acute, 274
osteomyelitis of upper jaw mistaken for, in young children, 285, 309
treatment by irrigation, 287
suppuration in, chronic
diagnosis, by puncture of antrum, 305
by signs and symptoms, 305
by transillumination, 301
symptoms, 291
treatment, 313-327
by alveolar puncture, 314
by irrigation through natural opening, 320
by puncture through canine fossa, 320
by puncture through inferior meatus of nose, 317
by radical methods, 322
author's operation, 325
Bönninghaus's operation, 327
Caldwell's operation, 323
Küster's operation, 326
Rouge's operation, 326
conclusions regarding simpler methods, 321
- Aprosexia, group of nervous symptoms due to nasal obstruction, 71
- Arsenic, cause of rhinitis, 132
- Arslan, on rhinitis caseosa, 80
- Asch's operation for septal deflections, 116
- Asthma, 256-265
associated with nasal obstruction, 74
conditions in proof of asthma being reflex nasal neurosis, 258
association with nasal disease, 258
effect of anæsthetizing nose, 259
effects of nasal treatment, 260
experimental production by irritating nose, 259
presence of nasal aura, 258
pathology, 257
treatment, general measures, 264
climatic, 264
dietetic, 264
local, 260-264
when nasal aura precedes asthmatic attack, 261
where definite nasal disease is present, 260
where no nasal symptoms are present, 262

- Asthma
treatment
by application of galvanocautery, 262, 263
- Atresia (congenital) of posterior choanae, 120
- Atropine, internal use in hay fever, 255
- Avellis on acute osteomyelitis of upper jaw mistaken for antral suppuration in children, 309
- BABER, E. CRESSWELL, incandescent spirit lamp for anterior rhinoscopy, 36
trochar and cannula for puncture of antrum, 317
- Bacillus diphtheriae (Klebs-Löffler), presence in fibrinous rhinitis, 135, 136, 137
presence in ozaena, 162
- Bacillus mucosus, presence in ozaena, 162
- Bacillus pseudo-diphtheriae (Hoffman's), presence in ozaena, 162
- Bécourt and Chevallier on trade rhinitis, 132
- Benign growths of nose, 219-226
- Bentzen, on cause of deformities of jaws and teeth, 69
- Bergengrün, on nasal leprosy, 214
- Blake's nasal snare, 192
- Blindness, result of nasal operations, 47
- Bloch, on cause of deformities of jaws and teeth, 69
on headache due to nasal affections, 87
- Blood, disorders of, causing epistaxis, 83
loss of, in nasal operations, 47
oxygenation of, deficient, symptom of nasal obstruction, 70
- Blood-letting (local) in treatment of acute sinus suppuration, 286
- Blood-pressure, increase in, temporary, causing epistaxis, 83
- Blood-supply of nose, derivation of, 24
- Bönninghaus, radical operation for chronic antral suppuration, 327
- Boerhaave, on treatment of polypi, 173
- Bond, J. W., curettement of malignant tumours of nose, 235
- Bone changes, caries or necrosis, associated with chronic sinus suppuration, 300
- Bone changes in nasal polypus, 180
- Bosworth, on causes of ozaena, 164
- Brindel, paraffin injections in treatment of ozaena, 169
- Brodie, T. G., and Dixon, W. E., experimental investigation of asthma, 245, 256
- Bronchiectasis, in sinus suppuration, 281
- Bronchitis (chronic) in sinus suppuration, 281
- Browne, Lennox, nasal speculum, 37
on epilepsy in nasal obstruction, 75
on relation between pneumonia and sinus suppuration, 271
- Bulla ethmoidalis, 6
- Buser, on cause of deformities of jaws and teeth due to nasal obstruction, 69
- CALDWELL, radical operation for antral suppuration, 323
- Canine fossa, operation through, in treatment of chronic antral suppuration, 320
- Cannula for use after external operation on frontal sinus, 344
for syringing antrum, 319
and trochar (Cresswell Baber's) for puncture of antrum, 317
(Krause's) for antrum, 319
- Carcinoma (nasal), alveolar, 231
causation, 233
of accessory sinuses, 232
squamous, 232
symptoms, 233
treatment, 235-239
See also Tumours of nose (malignant).
- Caries of nasal bones associated with chronic sinus suppuration, 300
of sinus walls due to chronic sinus suppuration, 279
- Cartilage (triangular) dislocation of, 111
- Catarrh of upper air passages, liability to, in post-nasal adenoid growths, 373
post-nasal, 367
treatment of, 368
See also Rhinitis
- Catheterization of frontal sinus through nose, difficulty of, 18-20
use of Röntgen rays in, 20
- Caustics, application of in nasal surgery, 51
- Cautery, *see* Galvano-cautery
- Cautery handle (Hovell's), 51
- Cavernous sinus, thrombosis of, in sinus suppuration, 282
- Cellulitis of orbit, 308
- Celsus on treatment of polypi, 173
- Cerebral cavity (diseases of) dependent upon nasal affections, 93
- Cerebral complications of sinus suppuration, 281, 282
- Cerebro-spinal rhinorrhoea. *See* Rhinorrhoea (Cerebro-spinal).
- Chest walls, deformity of, due to nasal obstruction, 72, 73
See also "Pigeon" breast.
- Chevallier and Bécourt on trade rhinitis, 132
- Chloroform in removal of adenoids, 379
- Choanae (posterior), anatomy of, 8
congenital atresia of, 120
treatment, 121
- Cholewa on cause of nasal polypus, 187
- Chondroma. *See* Enchondroma.
- Chorea, dependence upon adenoids, 374
in nasal obstruction, 76
- Christiansen on frequency of nasal tuberculosis and lupus, 208
on local treatment of nasal tuberculosis and lupus, 213
- Clarke, Payson, on cause of nasal polypus, 187
- Cleansing of nose, in ozaena, 167
methods of, 43-45
for children, 44
nasal cup, 43
nasal douche, 44
nasal irrigation, 43
packing the nose, 45
sprays, 44
syringing, 44
wool mops, 44, 45
nasal lotions for, 45

- Cocaine, application of in treatment of acute suppuration in accessory sinuses, 286
 danger of application in hay fever, 255
 effect of application to nasal mucous membrane, in asthma, 259
 in nasal operations, 48
 dangers of, 47, 48
 'Cold in the head.' *See* Rhinitis (acute simple)
- Collier, Mayo, on cause of deformities of jaws and teeth in nasal obstruction, 69
 on trigeminal neuralgia due to disease of middle turbinate, 90
- Cordes, investigations on nature of nasal polypus, 187
- Crusts, formation of, in ozaena, 158
 from retained nasal discharge, 78
 prevention of, in ozaena, 168
- Cupric electrolysis in ozaena, 170
- Curettement, in ozaena, 171
 in treatment of extensive suppuration in ethmoidal cells, 331
 results, 332
 in treatment of malignant tumours, 235
 in treatment of nasal polypus, 195.
- Curtis, Holbrook, immunisation against rose fever by injection of sterilised infusion of roses, 255
- Cyanosis, due to difficulty of breathing in nasal obstruction, 71
- Cyst of middle turbinate, diagnosis from nasal polypi, 190
See also Dental cyst and Mucocoele
- Cysts in nasal accessory sinuses due to chronic suppuration, 279
 in nasal polypi, 178
- DELPECH and Hillairet on trade rhinitis, 132
- Dental cyst, condition resembling manifest empyema, 309
- Development of nose, 9
- Digital examination of post-nasal space, 41
- Diphtheria and fibrinous rhinitis, 135
See also Bacillus diphtheriae, Bacillus pseudo-diphtheriae
- Discharge (nasal), alterations in, 77
 excessive, 77, 78
 remote effects of, 79
 muco-purulent, 78
 purulent, in sinus suppuration, 293
 foetor, 294
 periodicity of, 294
 origin, 299
 resemblance to that of ozaena, 294
 retained, formation of crusts and causation of foetor from, 78, 159
- Dixon, W. E., and Brodie, T. G., experimental investigation of asthma, 245, 256
- Dmochowski, bacteriological examination of cases of sinus suppuration, 270
- Döbeli on source of secretion in ozaena, 161
- Downie, Walker, on removal of nasal polypi in asthma, 261
- Drug rhinitis, 131
- Dunbar, serum treatment of hay fever, 256.
- Duplay, description of rhinitis caseosa by, 80
 speculum for anterior rhinoscopy, 38
- Dyspepsia in chronic sinus suppuration, 281
- EAR (diseases of) dependent on nasal affections, 91
 in chronic suppuration of accessory sinuses, 296
- Ears, effects of nasal obstruction on, 59
- Edwards on gonococcal infection of nose, 133
- Electric light for anterior rhinoscopy, 34
- Electrolysis in nasal surgery, 53
See also Cupric electrolysis
- Empyema (latent), diagnosis in, 298
 symptoms occurring in, 290-297
 (manifest), conditions resembling:
 dental cyst, 309
 malignant disease, 308
 mucocoele, 308
 orbital abscess or cellulitis, 308
 osteomyelitis of upper jaw, 309
 periostitis of upper jaw, 309
See also Accessory sinuses, suppuration in
- Enchondroma (nasal), 221
 diagnosis of carcinoma from, 234
- Endothelioma (nasal), 231
- Enuresis (nocturnal) associated with nasal obstruction, 74
 associated with adenoids, 375
- Epilepsy, dependence upon adenoids, 374
 in nasal obstruction, 75
- Epistaxis, common with adenoids, 375
 diagnosis, 84, 85
 etiology, 83
 constitutional causes, 83
 local causes, 84
 in rhinitis sicca, treatment, 152
 symptoms, 84
 treatment, 85
 operative, 86
- Epithelium covering inferior turbinate, 27
 metaplasia of, in ozaena, 163, 164
- Erysipelas, relationship to sinus suppuration, 270, 281
- Ethmoid bone, osteitis of, etiology, 188
 occurring in nasal polypi, 180
 cause of production of polypi, 187
 clinical evidence of, 182
 histological evidence of, 180
- Ethmoidal cells, anatomy of, 20
 mucocoeles of, 359
 suppuration in, diagnosis, 306, 308
 symptoms, 292, 293
 treatment, 328-334
 acute, treatment by irrigation, 287
 (extensive) treatment by curettement, 331-333
 (limited) treatment,
 by minor operations under cocaine anaesthesia, 328
 danger and uselessness of galvano-cautery, 329
 removal, partial or complete, of middle turbinate, 329, 330
 (manifest or complicated) treatment, 333, 334
- Ethmoidal region, malignant tumours of, operative treatment, 237
- "Ethmoiditis (necrosing)," 180
- Eucaïne as local anaesthetic, 49
- Examination of nose, 34-42
See also Rhinoscopy

- Experimental production of asthma by irritating nose, 259
- Eyes (diseases of) dependent on nasal affections, 91, 92
(weakness of) in chronic suppuration in accessory sinuses, 296
See also Blindness, Neuritis (optic)
- FACE (diseases of), dependent on nasal affections, 93
- Fibro-angioma (nasal), diagnosis of carcinoma from, 235
pathology, 225
prognosis, 225
symptoms, 224
treatment, 225
- Fibroma (nasal), 220
diagnosis of carcinoma from, 234
symptoms, 221
treatment, 221
of naso-pharynx (recurring), 239-241
diagnosis, 240
operative treatment, 241
by Nélaton's method, 241
pathology, 240
prognosis, 240
symptoms, 239
- Finder on nasal sarcoma, 228
- Fœtor due to retained nasal discharge, 78
of ozaena simulated by that of sinus suppuration, 294
result of retained secretions, 159
- Forceps (cutting) for sphenoidal sinus, 353
Grünwald's, 194
Juracz's for adenoid growths, 380
- Foreign bodies in nose, 97-101
causing supra-orbital headache, 88
diagnosis of, 99
diagnosis of carcinoma from, 235
of tertiary nasal syphilis from, 205
in accessory sinuses, 274
symptoms of, 98
treatment of, 100
- Fränkel, nasal speculum, 37, 38
recommendation of bromides in treatment of hay fever, 255
- Francis, A., on point of origin of nasal reflexes, 244
on asthma in relation to nose, 256, 258
intra-nasal application of galvano-cautery in treatment of asthma, 262, 263
- Franke, experiments on air pressure in nose during normal respiration, 30
- Frontal sinus, anatomy of, 14
catheterization of, 18-20
development of, 17
examination by Röntgen rays, 16
by transillumination, 16
external relations of, 17
mucocele of, 361
ostium of, 17
size of cavity, 15
suppuration in, symptoms, pain, 291
tenderness, 292
suppuration in, acute, treatment by irrigation, 288
suppuration in, chronic, diagnosis, 306
transillumination of, 304
- Frontal sinus
suppuration in (chronic)
treatment, 335-351
by external operation, 339-351
indications for, 340
objections to, 340
description of operation, 342
with external drainage
only, 349
with obliteration of cavity, 343
without obliteration of cavity, 345
method of Jansen, 340
of Killian, 341, 344
of Ogston, 340
of Ogston-Luc, 346
by intra-nasal irrigation, 336
puncture of floor of sinus from nose, 339
- Functions of nose, 29-32
See also Olfactory functions; Respiratory functions
- GALVANO-CAUTERY, application of
for reduction of swelling of inferior turbinate, 51, 52
in treatment of hay fever, 253
in treatment of nasal reflex neuroses, 249
in treatment of asthma, 262, 263
danger of, in treatment of suppuration in ethmoidal cells, 329
- Gerber and Meisser, theory of ozaena, 163
- Glanders, 217
diagnosis, 217
prevention and treatment, 217, 218
prognosis, 217
- Glandular tissue in nasal polypi, 178
- Glas, on fibro-angiomata, 225
- Gleason's operation for deflections of septum, 111
- Gonococcal infection causing purulent rhinitis, 133
- Grant, J. Dundas, on rhinitis caseosa, 80
on frontal headache associated with nasal disease, 90
- Grossheintz on cause of deformities of jaws and teeth, 69
- Grosskopf, epilepsy in nasal obstruction, 75
- Grünwald on hemicrania due to nasal affections, 87
on causation of ozaena, 159-161
on etiology of nasal polypi, 185
on experimental production of conditions simulating nasal polypi, 187
on repeated puncture of antrum to diagnose suppuration, 305
- Guder on nasal reflex neuroses, 246
- Guye on group of nervous symptoms (aprosixia) due to nasal obstruction, 71
- HACK, on nasal reflexes, 243, 244, 245
on application of galvano-cautery in treatment of nasal reflex neuroses, 249
- Hæmorrhage, arrest of, after operations, 53
arrest of, by means of nasal bag, 54
(secondary) after removal of adenoids, 381

- Hæmorrhage**
 after puncture of antrum, 316
- Hajek** on supra-orbital headache, 89, 90
 on relationship between pre-existing nasal obstruction and sinus suppuration, 272
 on objection to intra-nasal methods in suppuration in ethmoidal cells, 330
- Halliburton, W. D., and Hewlett, R. T.,** on secretion in cerebro-spinal rhinorrhœa, 79
- Harke** on etiology of suppuration in nasal accessory sinuses, 268
- Hasslauer,** on benign nasal growths, 219
- Hay fever,** 250-256
 associated with nasal obstruction, 74
 causes, exciting, 250
 exposure to pollen in air, 250
 predisposing, 250, 251
 general, 251
 local, 250, 251
 prognosis, 252
 symptoms, 251
 treatment, 252-256
 by galvano-cautery, 253
 by bromides, 255
 by removal of exciting cause, 252
 by removal of predisposing local cause, 252
 by serum (pollanthin), 256
 by turbinectomy, 253
 constitutional, 253
 palliative, 255
 danger of cocaine or supra-renal extracts, 255
- Headache,** due to nasal affections, 87-90
 in chronic suppuration of nasal accessory sinuses, 290
 in nasal obstruction, 88
 (frontal). *See* Headache (supra-orbital)
 (periodicity), suggestive of suppuration in accessory sinuses, 90
 (supra-orbital), causes of, 88-90
 cured by removal of middle turbinate, 89, 90
 due to foreign body, 88
- Hemicrania,** due to nasal affections, 87, 88
- Hemisine,** preparation of supra-renal gland extract, 50
- Heryng,** on origin of nasal reflexes, 244
- Herzfeld and Hermann,** bacteriological examination in sinus suppuration, 270
- Hewlett, R. T., and Halliburton, W. D.,** on secretion of cerebro-spinal rhinorrhœa, 79
 and Thomson, StClair, on purification of inspired air from micro-organisms, 31
- Hiatus semilunaris,** 6
- Hill, G. William,** on rhinitis caseosa, 80
- Hillairet and Delpech,** on trade rhinitis, 132
- Histology of nose,** 25-29
- Hoffman's bacillus.** *See* Bacillus, pseudo-diphtheriæ
- Hopmann,** on a definite type of skull in relation to ozaena, 163
- Horne, W. Jobson,** nasal probe, 39
- Hovell's cautery handle,** 51
- Howard's nasal bag** for arrest of hæmorrhage, 54
- Hyperosmia,** 95
- Hypertrophy of inferior turbinates.** *See* Rhinitis (hypertrophic)
- Hypertrophy (œdematous),** in chronic suppuration in accessory sinuses, 295
- INCANDESCENT spirit lamp** (Cresswell Baber's) for anterior rhinoscopy, 36
- Infective diseases (acute) causing suppuration in nasal accessory sinuses,** 267
 bacteriological evidence, 269
 clinical evidence, 267
 pathological evidence, 268
 (chronic), of nose, 200-218
 See also Glanders; Leprosy; Rhinoscleroma; Tuberculosis and Lupus; Syphilis
- Influenza cause of sinus suppuration,** 266, 267
 frequent cause of anosmia, 94
- Infundibulum,** definition of, 18
- JACQUES** on cause of nasal polypus, 187
- Jansen,** operation on frontal sinus, 340
 operation on sphenoidal sinus, 355
- Jaw (lower),** changes in due to nasal obstruction, 68
 (upper), changes in due to nasal obstruction, causation, 66
 deficient development, 63
 highness and narrowness of arch of hard palate, 63
 irregularity and crowding of teeth, 65
 V-shape of alveolar arch, 64
 osteomyelitis of, acute, diagnosis from antral suppuration, 285, 309
- Jousset,** epilepsy in nasal obstruction, 75
- Juracz's forceps** for adenoid growths, 380
- KASSEL** on nasal reflex neuroses, 245
- Kelly, A. Brown,** on transillumination of antrum, 302, 303
- Killian,** speculum for median rhinoscopy, 39
 operation for deflected septum, 114
 operation on frontal sinus, 341, 344
 on mucocele of frontal sinus, 361
- Kirkland** on etiology of suppuration in nasal accessory sinuses, 268
 on bronchitis and bronchiectasis complicating sinus suppuration, 281
- Klebs-Löffler bacillus.** *See* Bacillus diphtheriæ.
- Korner** on cause of deformities of jaws and teeth, 69
- Kratschmer** on nasal reflex neuroses, 245
- Krause,** nasal snare, 192
 method of treatment of antral suppuration, 318
 results, 319, 320
 antrum trochar and cannula, 319
- Krieg-Bönninghaus** operation for septal deflections, 114
- Küster,** operation for antral suppuration, 326
- Kuhnt,** operation for frontal sinus suppuration, 341
- LACK, LAMBERT,** cannula for antrum, 319
 cannula for frontal sinus, 344

- Lack, Lambert
and Sutherland, G. A. on congenital laryngeal stridor, 74
- Lake, R., anterior turbinectomy, 146
paraffin injections in ozaena, 169
- Lane, W. Arbuthnot, on cause of deformities of jaws and teeth, 70
on treatment of post-nasal adenoid growths, 377
- Laryngismus stridulus, benefited by removal of adenoids, 374
in nasal obstruction, 74
- Laryngitis in sinus suppuration, 281
- Larynx, effects of nasal obstruction on, 59
See also Spasm (laryngeal); Stridor (congenital laryngeal)
- Leprosy (nasal), 214
diagnosis, 215
of tertiary syphilis from, 205
symptoms, 214
treatment, 215
- Lermoyez on fate of micro-organisms introduced into nose, 31
on supra-orbital neuralgia caused by hypertrophy of inferior turbinate, 88
- Lewy on point of origin of nasal reflexes, 244
- Lime-light. *See* Oxyhydrogen lime-light
- Lipoma (nasal), 225
- Lotions (nasal), 45, 384
- Luc, operation for frontal sinus suppuration, 340, 346
See also Ogston-Luc
- Lungs (diseases of) dependent on nasal affections, 90, 91
effects of nasal obstruction on, 59
- Lupus, nasal, 208
See also Tuberculosis
- Lymphatic vessels of nose, 25
- MACDONALD, G., on asthma, 261
on cause of deformities of jaws and teeth, 70
on etiology of nasal polypi, 184
on nasal respiration during sleep, 72
- Mackenzie, Hunter, operative procedure in treatment of epistaxis, 86
- Mackenzie, Sir M., history of nasal polypus, 173
snare for removal of polypi, 192
- MacKeown on nasal respiration in sleep, 72
- Malignant disease, cause of suppuration in accessory cavities, 274
condition resembling manifest empyema, 308
diagnosis of, from nasal polypi, 190
of nose, 226-242
See also Tumours (malignant)
- Martin, Sidney, histological report upon specimens of ethmoid bone in nasal polypi, 180, 186
- Massei on rhinitis caseosa, 80
- Maxillary bones, changes in, due to nasal obstruction, 62
- Meatus inferior, 3
middle, 4
superior, 7
- Meisser and Gerber, on cause of ozaena, 163
- Meningocele (nasal), diagnosis of, from nasal polypi, 190
- Mental phenomena, in chronic suppuration in accessory sinuses, 296
in nasal obstruction, 71
- Menzel, method of injection of paraffin wax to remedy collapse of alae nasi, 82
- Meyjes on supra-orbital headache due to foreign body, 88
- Michel, on rhinitis caseosa, 80
on causation of ozaena, 159
- Microbic origin of ozaena discussed, 162
- Micro-organisms, purification of inspired air from, by nasal mucous membrane, 31
ultimate fate of when introduced into nose, 31
- Moure, E. J., employment of paraffin injections in treatment of ozaena, 169.
operation, for septal deflections, 117
- Mouth, effects of nasal obstruction on, 58
symptoms resulting from constantly open mouth in nasal obstruction, 61
- Mucocele of accessory sinuses, 358, 366
etiology of, 358
pathology of, 359
of antrum, 362
cases of, 363
extreme rarity of, 362
treatment of, 363, 365
of ethmoidal cells, 358, 359
external operation for, 360
projecting into orbit, 359
removal by snare, 360
of frontal sinus, 361
diagnosis of, 361
rarity of, 361
treatment of, 362
of middle turbinate, 358
symptoms of, 358
of sphenoidal sinus, 365
- Mucous membrane (of sinuses), changes in, due to suppuration, 279
(nasal) histology of, 26, 27, 28
respiratory functions of, 31
- NASAL bag, for arrest of hæmorrhage, 54
- Nasal cavity, dimensions of, 8
- Nasal cup, for cleansing nose, 43
- Nasal douche, 44
- Nasal irrigators, 43
- Nasal lotions, 45, 384
- Nasal neuroses. *See* Neuroses (nasal reflex)
- Nasal obstruction, 55-76
cause of suppuration in accessory sinuses, 272
chorea in, 76
congenital laryngeal stridor in, 74
cough in, 75
deficient oxygenation of blood in, 70
deformity of chest walls in, 72
effects (direct), alteration of voice and speech, 55, 57
anosmia, 55, 57
snoring, 55, 57
effects on ears, 59
on general health, 71
on larynx and lungs, 59

- Nasal obstruction**
 effects on maxillary bones and teeth, 62
See also Jaw (upper)
 on mouth, 58
 on nose, 57
 on pharynx, 58
 on post-nasal space, 58
 epilepsy in, 75
 hay fever and asthma in, 74
 headache in, 88
 laryngeal spasm in, 74
 laryngismus stridulus in, 74
 mental phenomena due to, 71
 nervous symptoms due to, 71. *See also*
 Aprosexia
 nocturnal enuresis in, 74
 persistence after removal of primary
 cause due to collapse of alæ nasi, 81
 stammering in, 75
 symptoms of reflex or obscure origin
 in, 74
Nasal probe, 39
Naso-pharynx, fibroma of, recurring, 239-241
See also Post-nasal space
Necrosis in connection with sinus suppura-
 tion, 280, 300
Nélaton, operation for malignant growths
 affecting posterior part of nose, 237
 operation for recurring fibroma of naso-
 pharynx, 241
Nerve supply of nose, 25
Nervous symptoms due to nasal obstruction,
 71. *See also* Aprosexia
Neuralgia (facial), due to nasal affections, 88
 (supra-orbital), due to hypertrophy of
 inferior or middle turbinate, 88
 (trigeminal), due to disease of middle
 turbinate, 90
Neuritis (optic), complication of sinus sup-
 puration, 282
Neuroses (nasal reflex), 243-265
 classification, 245
 definition, 243
 etiology, 244
 evidences of nasal reflex, 247
 mode of action, 245
 point of origin, 244
 prognosis, 248
 treatment, 248, 249
 general, 249
 local, 248, 249
See also Asthma, Hay fever
OBLITERATION of frontal sinus in chronic
 suppuration, 343
Oedema, localisation of, in diagnosis of
 chronic sinus suppuration, 300
Ogston, operation on frontal sinus, 340
Ogston-Luc operation on frontal sinus, 340,
 346
 mortality of, 347-349
Oils, use of, in nasal treatment, 46
Olfactory functions of nose, 30
Olfactory region, histology of, 28
Ollier, operation for malignant tumours of
 ethmoidal region, 237
Onodi, complications of sinus suppuration,
 282
Operations, anæsthesia (general) in, 50
 anæsthesia (local) in, 48
 antiseptics in, 50, 51
 application of caustics, 51
 arrest of hæmorrhage after, 53
 dangers attending, 46-48
 electrolysis, 53
 untoward results of, 47
Optic atrophy, result of operation, 47
Optic neuritis. *See* Neuritis (optic)
Orbit, abscess or cellulitis of, resembling
 sinus empyema, 308
 invaded by nasal osteoma, 223
 mucocoeles projecting into, 359
Osteoma (nasal), 222
 diagnosis of carcinoma from, 234
 pathology and symptoms, 222, 223
 treatment, 224
Osteomyelitis of upper jaw, diagnosis from
 antral suppuration, 285, 309
Oxyhydrogen lime-light, 36
Ozaena, age at which disease commences,
 154
 complications of, 166
 condition of inferior turbinates in, 156,
 165
 condition of middle turbinates in, 157,
 165
 congenital excessive roominess of nasal
 fossæ, a predisposing cause, 164
 definition of, 153
 diagnosis, 166
 epithelial metaplasia in, 163, 164
 etiology and pathology, 153, 159-164
 evidences of contagion in, 158
 exciting cause of, 154
 factor of, 159
 stimulated by that of sinus suppara-
 tion, 294
 formation of crusts in, 158
 hereditary disposition to, 158
 histology of, 157
 microbic origin discussed, 162
 physiognomy of, 155
 prognosis of, 171
 relation of tubercle to, 157, 163
 relation to rhinitis sicca, 161
 relation to hypertrophic rhinitis, 161
 relation to sinus suppuration, 159, 294
 sinus suppuration in, 157, 273
 source of nasal discharge in, 159-161
 symptoms of, 165, 166
 theory of definite type of skull in, 163
 treatment, 166-171
 cleansing of nose, 167
 general treatment, 168
 prevention of crusts, 167
 special methods, cautery, 171
 cupric electrolysis, 170
 curettement, 171
 massage, 169
 paraffin injections, 169
 serum therapy, 171
 treatment of complications, 168,
 169
PACKARD, on cause of nasal polypus, 187
Packing the nose, method of, 45

- Pain in chronic suppuration of nasal accessory sinuses, 290
(supra-orbital). *See* Headache (supra-orbital)
- Palate (hard), arch of, highness and narrowness due to nasal obstruction, 63
- Palate retractor for posterior rhinoscopy, 41
- Papilloma (nasal), 219
treatment, 220
- Paraffin lamp for anterior rhinoscopy, 36
- Paraffin wax, injections, in treatment of collapse of alae nasi, 82
in treatment of ozaena, 169
- Parker, C. A., experiments on path of air stream through nose, 29, 30
operative procedure in treatment of epistaxis, 86
- Parosmia, causes of, 95
- Partsch, operation for malignant growths affecting posterior part of nose, 238
- Perforations of septum, 124
- Peters, E. A., method of preparation of supra-renal gland extract, 49
- Pharyngitis, in sinus suppuration, 281
- Pharynx, effects of nasal obstruction on, 58
- Phthisis, erroneous diagnosis of, in cases of chronic sinus suppuration with pyrexia, 281
ozaena predisposes to, 158
tuberculoma or nasal tubercular tumour associated with, 211
- "Pigeon" breast due to nasal obstruction, 73
- Pneumonia after removal of adenoids, 381
relationship to sinus suppuration, 270, 281
(circumscribed), in chronic sinus suppuration, 281
- Pollanthin (Dunbar's serum), 256
- Pollen, exciting cause of hay fever, 250
- Polypi (nasal), 173-199
age of occurrence, 176
associated with sinus suppuration, 295, 300
clinical and pathological features, 174
complicating ethmoidal suppuration, 331
cystic, 178
diagnosis, 190
from cyst of middle turbinate, 190
malignant disease, 190
meningocele, 190
syphilis, 190
tubercular tumours, 190
definition, 173
dimensions of, 175
etiology, 184-188
polypi connected with osteitis of ethmoid bone, 180, 182, 186, 187
frequency of occurrence, 176
histology, 177, 179
historical account of, 173
in nasal accessory sinuses, 279
pedunculated, sessile or papillary, 175
relation to sinus suppuration, 179, 183, 185
See also Accessory sinuses (suppuration in)
site of attachment, 176
symptoms, 189
tendency to recurrence, 177
- Polypi (nasal)
treatment, 191-198
when bone disease not active, 191
prognosis, 193
with extensive bone disease, 194-198
radical operation, 195-197
results, 197, 198
with limited bone disease, 194
- "Polypus (bleeding)," of septum. *See* Fibro-angioma
- Post-nasal adenoid growths. *See* Adenoid growths
- Post-nasal catarrh, 367
- Post-nasal space, affections of, 367-383
effects of nasal obstruction on, 58
- QUINSY, in connection with sinus suppuration, 281
- RADIUM, in treatment of nasal lupus, 214
- Reflex neuroses. *See* Neuroses
- Respiration, air pressure in nose during, 30
during sleep, 72, 73
importance of inferior turbinates in, 32
- Respiratory functions of nose, 30, 31
- Respiratory region of nose, lining of, 26
- Rhinitis (acute), 127-138
(acute, simple), 127-131
as cause of suppuration in accessory sinuses, 272
causes of, exciting, 128
predisposing, 127
diagnosis of, 129
pathology of, 129
prognosis of, 129
symptoms of, 128
treatment of, 129
general, 130
local, 129
prophylactic, 131
- (atrophic). *See* Ozaena (caseosa), 80
treatment of, 80, 81
- (chronic), 139-152
(hypertrophic), 142-149
diagnosis of, 143
etiology of, 142
pathology of, 142
symptoms of, 143
treatment of, 144
removal of anterior hypertrophies, 144
removal of posterior hypertrophies, 145
turbinectomy, total, 146-148
- (simple),
diagnosis of, 141
etiology of, 139
pathology of, 140
prognosis of, 141
symptoms of, 140
treatment of, 141
- (croupous). *See* Rhinitis (fibrinous)
- (drug), 131
- (fibrinous), 134-138
bacteriology of, 136
clinical features of, 135
pathology of, 136

- Rhinitis**
 (fibrinous)
 treatment of, 137, 138
 (membranous). *See* Rhinitis (fibrinous)
 (purulent), 133-134
 diagnosis of, 134
 symptoms of, 134
 tendency to produce ozaena, 164
 treatment of, 134
 (sicca), 149-152
 causation of, 149
 epistaxis in, treatment, 152
 obstruction of one nostril in,
 treatment, 151
 ozaena not allied to, 161
 pathological results of, 150
 symptoms of, 150
 treatment of, 150
 (symptomatic), 134
 (traumatic or trade), 131-133
 (vasomotor). *See* Hay fever
- Rhinoliths**, 101
 treatment of, 102
- Rhinorrhoea** (cerebro-spinal), 79
 cerebral symptoms of, 79
 etiology, 79
 (paroxysmal). *See* Hay-fever
- Rhinoscleroma**, 215
 diagnosis of, 216
 of tertiary nasal syphilis from, 205
 geographical distribution of, 215
 pathology of, 216
 treatment of, 216
- Rhinoscopy** (anterior), 34-39
 by electric light, 34
 by gas light, 35
 by incandescent spirit lamp, 36
 by oxyhydrogen lime-light, 36
 by paraffin lamp, 36
 objects seen in, 38
 position of patient in, 36
 speculum for, 37
 (median), speculum for, 39
 (posterior), 40
 objects seen by, 41
- Röntgen rays**, discovery of frontal sinuses
 by, 16
 in catheterization of frontal sinus, 20
- Root**, epilepsy in nasal obstruction, 75
- Rose fever**: immunisation against, 255
 See also Hay fever
- Rouge**, operation for malignant tumours of
 anterior part of nose, 236
 operation for resection of antro-meatal
 septum, 236
- SARCOMA** (nasal), 227
 diagnosis, 230
 prognosis, 231
 symptoms, 228-230
 treatment, 235-239
 See also Tumours of nose (malignant)
- Schmiegelow** on diseases of eye dependent
 on nasal affections, 92
- Secretion** (nasal). *See* Discharge (nasal)
- Semon**, Sir F. on Dunbar's serum treatment
 of hay fever, 256
 on treatment of asthma, 256
- Sepsis** after nasal operations, 47
- Septic absorption** following operations for
 sinus suppuration, 281
 in chronic suppuration in accessory
 sinuses, 296
- Septum**, abscess of, 121-124
 diagnosis, 122
 pathology, 122
 symptoms, 122
 treatment, 123
 adhesions between septum and outer
 wall of nose. *See* Synechia
- affections** of, 104-126
 anatomy of, 1
 "bleeding polypus" of. *See* Fibro-
 angioma
 deflections and deformities of, 104
 association with high and narrow
 arch of palate, 63
 diagnosis, 107
 etiology of, 105
 pathological conditions in, 104
 symptoms, 107
 treatment, 108
 by Asch's operation, 116
 by Gleason's operation, 111
 by Krieg-Bönningshaus opera-
 tion, 114
 by Moure's operation, 117
 by submucous resection, 114
 in narrowed noses, 112
 when complicated, 113
 when simple, 111
 perforations of, 124
 ulcer of (atrophic or perforating), 125,
 152
 etiology, 125
 symptoms, 126
 treatment, 126
- Serum** treatment of hay fever, 256
 of ozaena, 171
- Shock** in nasal operations, 46
- Siebenmann** on etiology of suppuration in
 nasal accessory sinuses, 267
- Sinusitis** (multiple), treatment, 311
 order of opening sinuses, 312
 See also Accessory sinuses, suppura-
 tion in
- Sleep**, disturbed rest and sleep in nasal
 obstruction, 70
 obstructed nasal respiration during, 72,
 73, 373
- Smell**. *See* Olfactory functions
- Smell** (sense of), loss of. *See* Anosmia
 perversion of. *See* Parosmia
- Smells**, sensitiveness to. *See* Hyperosmia
- Snares** for removal of nasal polypi (Blake's,
 Krause's, Mackenzie's), 192
- Snoring**, in nasal obstruction, 55, 57
- Snow**, Sargent, on hemispheres due to nasal
 affections, 88
- Spasm** (laryngeal) in nasal obstruction, 74
- Speculum** for anterior rhinoscopy (Duplay's,
 Fränkel's, Lennox-Browne's, Thudichum's),
 37, 38
 for median rhinoscopy (Killian's), 39
- Speech**, alteration in nasal obstruction, 55,
 57

- Spheno-ethmoidal recess, 7
- Sphenoidal sinus, 22
 anatomy of, 22, 23
 cranial relations of, 24
 development of, 24
 mucocele of, 365
 suppuration in, acute, treatment by irrigation, 288
 chronic, diagnosis, 307
 symptoms, 292
 treatment, 352-356
 by external operation, 355
 by intra-nasal operation, 352
 by irrigation through natural opening, 352
 by Jansen's operation, 355
- Sprays for cleansing nose, 44, 386
- Stacy, bacteriological examination of cases of sinus suppuration, 270
- Stammering associated with nasal obstruction, 75
- Steam inhalations, 46, 386
- Steward, F. J., on frequency of nasal tuberculosis, 208
- Stridor (congenital, laryngeal), in nasal obstruction, 74
- Submucous resection of septum, 114
- Suppuration in accessory sinuses of nose, relation of nasal polypi to, 179, 183, 185
See also under Accessory sinuses;
 Frontal sinus, etc.
- Supra-orbital headache. *See* Headache (supra-orbital).
- Suprarenal extracts in treatment of acute sinus suppuration, 286
 as local anæsthetic, 49
 preparation of, 49, 50
- Sweating, profuse, in nasal obstruction, 71
- Synechiæ, 119-120
 causation of, 119
 treatment of, 119
- Syphilis (nasal), 200-208
 (hereditary), 207
 (primary), 200
 (secondary), 201
 (tertiary), 201
 cause of suppuration in accessory sinuses, 274
 deformities resulting from, 202-204
 diagnosis of, 205
 from foreign body in nose, 205
 leprosy and rhinoscleroma, 205
 lupus, 205
 polypi, 190
 sinus suppuration, 205
 prognosis of, 205
 symptoms of, 201
 treatment of, general, 205, 206
 local, 206
 ultimate results of, 204
- Syringing the nose, 44
- TEETH, effects of nasal obstruction on, 62
 irregularity and crowding due to nasal obstruction, 65
 (carious) causing suppuration in antrum, 274
- Tenderness in chronic suppuration of nasal accessory sinuses, 292
 in nasal disease, 87
- Thomson, StClair, epilepsy in nasal obstruction, 75
 on cerebro-spinal rhinorrhœa, 79
 and Hewlett, R. T., on purification of air from micro-organisms, 31
- Thost on Dunbar's serum in hay fever, 256
- Thrombosis of cavernous sinus, 282
- Thudichum's speculum, 37
- Tomes, Sir J., on cause of deformities of jaws and teeth, 68
- Tonsillitis (septic) in sinus suppuration, 281
- Torstenson on origin of nasal reflexes, 245
- Torticollis, after removal of adenoids, 381
- Trade rhinitis. *See* Rhinitis (traumatic)
- Transillumination, electric lamp for, 301
 in antral suppuration, 301
 in frontal sinus suppuration, 304
- Triangular cartilage. *See* Cartilage (triangular)
- Trochar and cannula (Cresswell Baber's) for puncture of antrum, 317
 (Krause's) for puncture of antrum, 319
- Tubercular tumours, diagnosis of from nasal polypi, 190
- Tuberculoma, nasal, 211
 commonly associated with phthisis, 211
 treatment, 213
- Tuberculosis, relation to ozaena, 157, 163
See also Phthisis
 (nasal) as cause of suppuration in accessory sinuses, 274
- Tuberculosis and lupus (nasal), 208
 diagnosis of, 212
 etiology of, 209
 pathology of, 209
 prognosis of, 212
 symptoms of, 212
 treatment of, 212
 general, 212
 local, 213
See also Tuberculoma
- Tumours of accessory sinuses, 219-242
 (malignant) of accessory sinuses, operative treatment, 238
- Tumours of nose, 219-242
 benign growths, 219-226
 See also Adenoma, Enchondroma, Fibroma, Fibro-angioma, Lipoma, Osteoma, Papilloma
 malignant growths, 226-242
 See also Carcinoma, Endothelioma, Fibroma (recurring), Sarcoma
 of anterior part, operative treatment by curettement, 235
 by Rouge's operation, 236
 of ethmoidal region, operative treatment, external operation (Ollier's method), 237
 through natural passages, 237
 of posterior part, operative treatment, 237
 Nélaton's method, 237
 Partsch's method, 238
 palliative treatment, 238
- Turbinate (inferior), 3
 condition in ozaena, 156, 165

- Turbinate (inferior)
 epithelium covering, 27
 hypertrophy of, as result of nasal obstruction, 58, 142
See also Rhinitis (hypertrophic)
 importance in respiration, 32
 swelling of, 139
 reduction of, by application of galvanocautery, 51, 141
 removal of. *See* Turbinatectomy
- Turbinate (middle), 5
 condition in ozaena, 157, 165
 enlargement or cystic disease of, 188
 diagnosis of, from nasal polypi, 190
 mucocele of, 358
 removal of, anterior extremity of, 193
 in supra-orbital headache, 89, 90
 in trigeminal neuralgia, 90
 in chronic suppuration of frontal sinus, 335
 in hay fever, 253
- Turbinate (superior), 7
- Turbinatectomy, in hay fever, 253
 in asthma, 261
 (anterior), 146
 (posterior), 145
 (total), 147
 after-treatment of, 148
 results of, 148
- Turner, A. Logan, on transillumination in antral suppuration, 303
 on mucocoeles, 359, 361, 362
- Turner, J. G., on changes in maxillary bones and teeth due to nasal obstruction, 62
- ULCER of septum, atrophic, 125
 perforating, treatment, 152
- Uncinate process, 6
- VENOUS engorgement causing epistaxis, 84
- Vestibule of nose, 25
- Voice, alteration in, in nasal obstruction, 55
- Voltolini, on treatment of asthma, 256
- WALSHAM, W. J., operation for collapse of alæ nasi, 81
- Weichselbaum, on etiology of suppuration in nasal accessory sinuses, 268
- White's palate retractor, 41
- Wilkins, on transillumination in antral suppuration, 302, 303
- Wingrave, V. W., on histology of accessory sinuses, 29
- Woakes, E. W., on nasal polypus as a symptom of "necrosing ethmoiditis," 180, 186, 187, 189
- Wool mops for cleansing nose, 44
- YONGE, on nature of nasal polypus, 187
- ZAUFAL, theory of congenital absence of inferior turbinates in ozaena, 163
- Ziem, experiments to prove cause of deformities of jaws and teeth, 70
 on suppuration in nasal accessory cavities, 266
- Zuckerkindl, on congenital perforation of septum, 124, 126
 on site of attachment of polypi, 177
 on cause of nasal polypus, 187

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